POULTRY MANAGEMENT AND PRODUCTION

EXPLANATORY NOTE

For the information in particular of officers in developing areas

THE information in this book does not only apply for Australia, but gives data on the variations needed for use by officers in areas where poultry-keeping is in the earlier stages of development.

The main alterations apply to housing designs, feeding rations, types of equipment, and training and management procedures. This information is given in considerable detail in Appendixes Nos. 1 to 8, where the appropriate chapters in the book for further reference are indicated.

Some examples are: how to adjust for a simple and cheaper feeding basis with local ingredients; how to design the sheds for efficient results in tropical areas; stress on deep litter practice for use in developing areas because of its high economic return for fertilizer use. The coverage of the book extends from the simple requirements of village or backyard production, with low-cost housing and feeding, to the gradual expansion to larger units suited to these areas—with needed adaptations stressed—and finally to the more efficient units, in Australia in particular.

This means that the book will serve as a reference guide to cover all stages and thus assist the officer over a long period of time, to keep him abreast of the practical moves needed as the scope of operations expands in a particular area. It is suggested that a study of Appendixes 1-8 (pp. 641-732) prior to dealing with the main chapters, may be helpful on the various aspects involved with training of operators and also in the introduction of new techniques in developing areas.

As the result of long experience by the author in Australia and in areas developing poultry programmes, a most comprehensive volume of essential information on required practices for the establishment and development of poultry is available in this book.

In reference to exchange, the Australian dollar quoted is equivalent to £stg·4 or U.S.$1·1. Local adjustment can be made from this.

Agricultural and Livestock Series

Poultry Management and Production

BY

ALLAN A. McARDLE

Poultry Production Adviser, Food and Agriculture Organization of the United Nations, and formerly Senior Poultry Adviser, Department of Agriculture, South Australia

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FOREWORD

THE Tenth Session of the FAO Conference in 1959 approved the Director-General's proposal to organize, in co-operation with the United Nations, other Specialized Agencies, FAO Member Governments and Non-Governmental Organizations, a world-wide Freedom from Hunger Campaign One of the aims of this Campaign is to utilize the opportunities offered by modern techniques for producing sufficient food of the right kind for everyone

The present book aims at providing poultry keepers in Australia and other countries, particularly those in tropical and subtropical areas, with up-to-date information to operate their poultry units, whether large or small, in an efficient and economical manner This publication is, therefore, well in line with the objectives of the Freedom from Hunger Campaign

The methods described are based on research, extensive study and long experience by the author, Mr Allan A McArdle, who deals not only with the poultry industry of Australia but also with methods used in the United States of America which he visited as a member of an official Australian Study Team some years ago Moreover, as a result of the successful work accomplished by the author in India, in his capacity as Poultry Production Expert of the Food and Agriculture Organization of the United Nations, practices well-suited for tropical areas are described in this book

Particular attention has been paid to the adaptations required under tropical conditions with regard to poultry housing and management as well as the use of local by-products suitable as feeding stuffs for poultry Accordingly, this book is of considerable value both to poultry keepers in Australia and elsewhere, as well as to veterinary and agricultural students and extension workers

This publication is thus a noteworthy contribution to the Freedom from Hunger Campaign I hope that it will have a wide distribution and I extend my gratitude and compliments to its author

K V L KESTEVEN
Director
Animal Production and Health Division
FAO, Rome, Italy

ACKNOWLEDGMENTS

ACKNOWLEDGMENT is made to Dr A. R. Callaghan, C.M G , formerly Director of Agriculture, South Australia, for his encouragement in the writing of the first edition of this book, and also to the late Mr C. F. Anderson, M B E , formerly in charge of Poultry Section, Department of Agriculture, South Australia, and to fellow departmental officers, for their helpful co-operation Thanks are expressed for help received in discussions with officers in various countries, with representatives of firms associated with the industry, and with private poultry farmers in the field, also to the poultry press, whose publication of material on all aspects of poultry development, of both private and official nature, was an appreciated aid to the background of this book

Where indicated, acknowledgment is made to the published work of senior poultry officers in the various States Mention is made of current literature used, and appropriate reference books are suggested in the text

For disease reference work in Australia, *Diseases of Poultry* Third Edition 1962, by T. G Hungerford, also published in the Agricultural and Livestock Series, is recommended Further references to this excellent publication are made in the text

Acknowledgment is also made to Dr Hans Engler, Chief, Poultry Production Section, Animal Production Branch, Food and Agriculture Organization of the United Nations, Rome, Italy, for his greatly appreciated wholehearted support, encouragement and direction while working in India, during the preparation for the second edition Appreciation is also expressed of the considerable help and co-operation given by J N Panda when acting as my counterpart on work in India, firstly while he was Poultry Development Officer in Orissa and later as chief poultry officer, Government of India, in Delhi, on the various phases of poultry-production peculiar to tropical and subtropical areas

ALLAN A. MCARDLE

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CHAPTER 1

INTRODUCTION

POULTRY-FARMING in Australia was in its infancy at the beginning of the present century, and the majority of eggs came from hens kept on general farms and by backyard hobbyists Commercial farms were very few The quality of the eggs was seldom given serious consideration, and the main source of supply of chickens was from broody hens and from small incubators operated on units belonging to enthusiasts In Australia the tendency towards specialization began after World War I, when hatcheries were established, enabling the number of chickens produced to be greatly increased

The economic depression in the years between the late twenties and the early thirties was responsible for a great many people taking up poultry-keeping as a means of livelihood or of supplementing their income The marketing of eggs became a major problem, and organizations were formed to promote sales of eggs graded according to quality During the spring, the most productive period, the number of eggs gradually began to exceed local requirements, and arrangements were made to export the surplus ones of good quality to the United Kingdom

The industry continued to expand during the 1930s, and there was increasing competition on the egg market during flush periods because of this, further improvements became necessary in production methods Laying competitions conducted in New South Wales and the other States since the early years of the century had shown that Australian bred stock could produce eggs that compared favourably with those of other countries in size, quality, and numbers

A stabilized market during World War II gave further impetus to the industry, and this very large primary industry continued to grow steadily after the war Changing conditions made it necessary to improve poultry-farming practices in order to maintain a payable margin, and methods were evolved that enabled more birds to be kept with very little or no increase of labour, both on commercial farms and on sideline units The sideline units are, and always have been, the main sources of egg-supply in Australia

The question that vitally concerns every poultry farmer is that of the labour-profit margin, increasing specialization and the use of improved techniques are now necessary on units of all sizes

In this book the returns that can be expected—if the unit is run by the methods described—are worked out with varying feed costs and egg prices, and with methods that can apply in many areas of operation Thus the poultry-farmer is given an idea of the cost involved in running a unit, and he can take steps to reduce operating costs to a minimum by improving the efficiency of his stock and plant by the methods suggested In this way

the returns from the production either of eggs or of table poultry will be increased. Plant of various types is described, and details are given of sheds and equipment that will give good results while being as economical as possible. Information is also provided concerning modern plant for large commercial farms. The various chapters on husbandry cover in a simple and practical manner the requirements for efficient production.

The basic requirements given here cover all branches of commercial production and provide a sound basis for operations. They are applicable to part-time production of poultry on general farms where grain is produced as well as to commercial poultry-farms where the keeping of poultry is the sole means of livelihood.

Many engaged in poultry reach the peak of efficiency in one branch—it may be in hatchery operations, in the raising of young stock, or in egg production or one of the other aspects of the poultry industry. The sideline producers, who supply most of the eggs produced in Australia, may not be as well acquainted with the newest and best practices—usually they have not the varied experience that the commercial producers have had, nor have they had access to sources of technical knowledge. The use of the types of plant discussed in this book, together with an observance of the simple husbandry rules expounded, should help the sideline producer to increase his returns with the minimum amount of labour. Most of the basic research publications are more suitable for research and extension workers than for the general poultry-farmer, and one of the aims of this book is to make available in simple language the results of research into various aspects of the industry.

I have not included a full discussion of poultry diseases, for this book is concerned with poultry husbandry only. Sufficient direction is given, of course, to enable preventive husbandry methods to be used, and when *necessary the reader is directed to diagnostic services. Appropriate* reference on poultry diseases is given.

Some important considerations for those taking up poultry-farming, whether commercial or sideline, are set out below, together with references to the chapters that relate to these matters.

1. The land and the site should be carefully investigated before you establish your poultry-farm. Consider the availability of the various essential services and facilities, and the cost of the plant, equipment, and stock. Allowance must be made for unforeseen eventualities. A knowledge of the efficient conduct of a poultry-farm is essential, and you should assess your capabilities and aptitude for the work and decide whether you can adapt yourself to life on a poultry-farm. Refer to Chapters 3 and 4 for discussion of these points.

2. Plan the financial outlay for the unit. Adopt the most efficient system for the locality you have in mind. The unit must be large enough to be payable, and the cost of labour must be considered, also the returns to be expected. In assessing the efficiency of a unit, the total egg production and not the number of birds is the main consideration. For a sideline unit 400 to 600 layers are suggested, and for a one-man commercial unit, for egg production only, 1800 to 2500 birds will be needed. Other avenues in the poultry industry are discussed in Chapters 4 and 8.

3 Ascertain the ruling feed costs and egg prices on the farm Arrive at the likely return from the poultry by using the ready reckoner graphs and tables given in this book Refer to Chapters 3, 14, and 17

4 Select a suitable source for stock, based on random test performance, and replace at least two-thirds of the stock each year with pullets It is expected that these will be crossbreds This will enable you to maintain an efficient level of production, particularly during the difficult off-season If you raise your own replacements, carry out correct incubation practice and follow a sound breeding programme Rate of lay per bird is the main factor in securing profitable returns Refer to Chapters 5, 6, 7, and 9

5 Raise the young stock by proved methods of housing and feeding in separate isolated quarters, on range or intensively Feed on one of the proved and tested feeds described, or use prepared feeds from reliable sources Refer to Chapters 10, 11, and 14

6 To avoid unnecessary labour avail yourself of efficiency practices in the handling of poultry Operations such as feed storing, feeding, watering, collection and handling of eggs, cleaning of sheds, can all be carried out economically with efficient methods Adopt the housing that is most suited to your district Periodically cull the stock and check the plant Refer to Chapters 12, 13, 14, 16, and 17

7 Use the basic rations recommended for feeding layers, or buy from reliable proprietary sources Do not forget the value of greenfeed in fresh or dried form—it will help to maintain good health Check for possible economies through the use of various grains Use the laying rations suggested so as to obtain the highest possible number of eggs without extravagant use of feed Refer to Chapters 14, 15, and 17

8 A regular routine of preventive methods for the control of disease is necessary Use the methods suggested for the control of such diseases as pullorum, worm infestation, and fowl pox in young stock Watch for vermin on the birds and for external parasites around the poultry unit Sickness and mortality make a heavy drain on returns, and prevention should be the rule Refer to Chapters 7, 17, and 22

9 Poultry meat production can be a valuable sideline or commercial enterprise when the margin of poultry meat prices over feed costs is favourable Refer to Chapters 18, 19, 20, and 21 for discussion of the possibility of producing poultry meat given satisfactory feed costs and production methods

10 A successful poultry unit depends upon the capacity of the poultry-farmer to conduct the unit on a business like basis Labour, stock, and plant must be used to the best advantage the proved husbandry methods described in this book will help to achieve this

11 Appendixes 1-8 are suggested for study by officers or poultry keepers in developing areas prior to complete coverage of the references indicated under 1-10 relative to establishing a poultry unit

CHAPTER 2

THE AUSTRALIAN POULTRY INDUSTRY TODAY

THE poultry industry is one of the six main primary industries of Australia The annual production of eggs, from all sources of supply, is valued at over $90,000,000 The meat-production side of the industry is also of considerable importance, the combined value of poultry-meat production as a specialized avenue (which has made rapid growth in the last few years) and of cull birds being estimated at over $60,000,000 (1963-4)

As in other egg producing countries, many of the eggs come from farms where poultry is not the sole means of livelihood but is regarded as an adjunct to other pursuits These sideline units absorb a portion of the produce, such as grain, from the farm The commercial poultry-farms in Australia, whose proportion of production is increasing, are of course solely dependent on poultry for their means of livelihood, and many of our best plants compare favourably with any in the world

On a population basis, the value of eggs produced in Australia is as great as in any other country Although there are many farms where efficiency is low, the best farmers in the breeding and husbandry spheres in Australia are capable of holding their own with those of any oversea country This was borne out by the results of the field survey of the poultry industry made in 1953-4 by the Bureau of Agricultural Economics of Canberra A random sample selection of commercial units was made for the survey, which covered all the mainland States The efficiency of the better farms is shown by the following figures Of those farms which produced over the level of 13 dozen eggs per bird, 28 per cent averaged over 15 dozen per bird The averages were for the 13 to 15 dozen group, 14 04 dozen, for the 15 dozen and over group, 15 94 dozen These figures are for all ages of stock on the unit Subsequent surveys in various States indicate, with the improved genetic material now available, that higher production levels are being obtained

The excellent results of the higher groups were obtained by men who operated on approved lines and made a study of the industry One of the objects of this book is to describe the type of husbandry that has proved effective, in order that a greater number of people will become efficient and so cause the average production to be increased

Many fine economic poultry plants have survived through years of depressed egg prices, high prices for feed, and short supply or complete unavailability of materials—including essential proteins Despite this, the industry is now larger than it was before World War II

LARGE UNITS

In Australia there are many big poultry-farms. the largest private egg farm in the world is to be found in Victoria; in New South Wales the

biggest egg-floor in the world handles over twenty-five million dozen eggs each year. Integration of many operations has led to large all-purpose units

Hatcheries capable of holding more than a hundred thousand eggs are established in the various States, and the hatching percentages and other results equal those of other countries. The industry is one where initiative has had to play a leading part, for there has been widespread prejudice against it because of its reputedly poor economic return It has now, however, entered a more established phase. It is encouraging to know that some of the biggest and most efficient units have begun in a very unpretentious manner, and have developed into the fine poultry units that they are through correct practices.

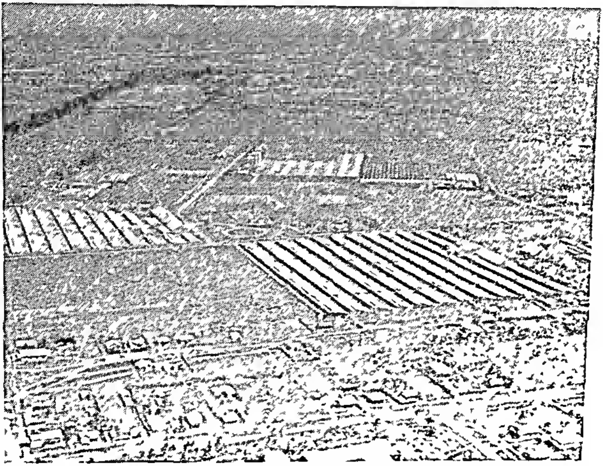


Fig. 1. The largest private poultry-farm in the world at Werribee, Victoria

EXTENSION SERVICES

Various forms of extension services have been made available by the State governments, and in recent years these have been supplemented by Commonwealth extension grants. Egg-laying tests conducted in each State act as a medium for checking and improving the laying ability of various strains and breeds or combinations of breeds, and they enable mortality figures to be recorded and production costs to be assessed As a further incentive, extensions of these facilities are being provided in the various States. Research and diagnostic services have also been made available to the industry, and in addition advisory services on husbandry practices

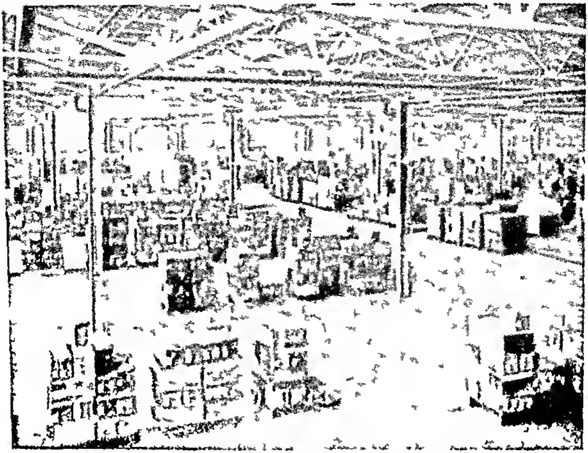
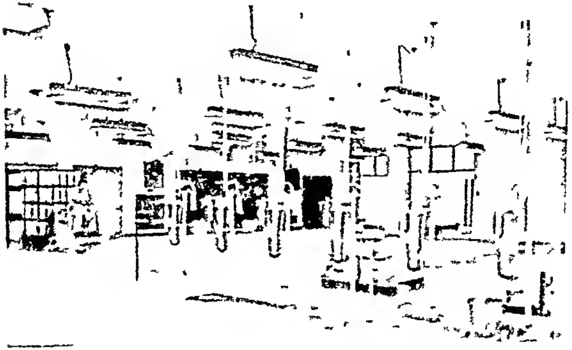


Fig 2 The largest and most up to date, single unit, egg handling floor in the world—that of the New South Wales Egg Board at Lidcombe

Above View of main floor showing eggs received for grading

Below Vacuum extractor units, each of which is capable of putting through up to 2000 dozen eggs per day



—(By courtesy of the N S W Egg Board)

so necessary to successful poultry-keeping—have been provided in each State and are being extended Practical examples of husbandry methods have been a function of experimental stations as well as experiments in hatching, rearing, feeding, housing, breeding—in short, all aspects of poultry husbandry and management Included in these experimental stations are Seven Hills Experiment Station, the Poultry Husbandry Foundation, Glenfield Research Institute, the C S I R O Poultry Research Centre, N S W , State Experiment Farm at Werribee, Victoria, Parafield Poultry Experiment Station, South Australia, various departmental poultry centres in Queensland, the departmental station and "pilot" farms operated in Western Australia In Tasmania the Random Test centre provides facilities for improvements in poultry husbandry

The standard and proven methods advocated by the State departments of agriculture have been of material assistance to the industry, and many of the most efficient plants in Australia owe their progress to the use of these methods Practices such as are advocated by the departments—particularly in the sphere of breeding, rearing, feeding, and housing—enable poultrymen to achieve efficient operation

Many owners of private poultry-farms have assisted in field work, various associations and clubs, maintaining breed standards and encouraging co operation among poultrymen The poultry press has also done its part in spreading the results of research and experiment-station work, both from Australia and overseas

The importance of the industry is growing A Poultry Science School was held at Werribee 1957, followed by Refresher Courses for officers such as at Hawkesbury in 1967 and the first Poultry Science Convention in Sydney 1959 with further Poultry Conventions in Sydney in 1961 also Queensland 1964 and 1966 The 12th World Poultry Science Congress was held in Australia 1962 and the industry is departing from traditional methods to lines of husbandry for easier and better working methods based on scientific principles of labour feed and stock use

FACTORS AFFECTING EGG CONSUMPTION

In all the Australian States, Egg Boards have operated for stabilization purposes, within each State only A new phase in marketing has now come about, with Commonwealth legislation having linked the operations of the State and the Commonwealth authorities The quality of the eggs for sale has vastly improved since the early days of the industry Today, with greater knowledge of keeping quality and with modern testing and grading facilities, the producer has his eggs sold in standard grades, with benefit to himself as well as to the consumer The producer is responsible for some aspects of the attractiveness of eggs, but this quality is also the responsibility of those who handle them after they are produced

The attractiveness and marketability of eggs depend on (*i*) size, soundness of shell, and colour of yolk (this is achieved by means of correct breeding and feeding), and (*ii*) frequent collection and marketing, ensuring freshness Eggs for market should also be infertile, and kept cool

The agent who grades the eggs must see that they are handled quickly when being sent on to their next stage—either for storage before export or

future local sales, or direct to local retailers in case-lots or attractively packaged in individual cartons (Premium rates may be a future possibility for farms supplying eggs to be marketed in individual cartons, with advertising matter on these indicating features of the eggs packed The requirements would be on the lines of a guarantee that the eggs were marketed within four days of being laid, were infertile, of uniform shape, weight, and shell colour, and also had deep uniform golden yolk colour)

When graded, eggs are sent out for sale as first-quality eggs, and if the retailer holds them in a refrigerated window or case they maintain their quality for many days, but if placed in a basket on the counter—particularly during warm weather—they rapidly lose quality Customers notice the way in which eggs are presented for sale attractively packaged and displayed eggs kept in cool storage appeal more than those in an open basket on the counter, and the latter give them doubts as to whether all the eggs were cleared from the basket before others were put into it

The consumer must take proper care of the eggs he has bought if they are taken home in first class condition and then left in a warm kitchen for a week, they will lose quality When the egg-white is found to run in the pan or dish, the source of supply of the eggs is often blamed, whereas inefficient home storage is responsible In warm weather the consumer should store eggs in a cool spot, preferably in a cool-safe, ice-chest, or refrigerator, kept free from strong odours

These are some of the aspects of the quality factor that affect egg consumption Another aspect is that of price Consumers (or housewives) will not pay more than a certain price for eggs, and this must be kept in mind in fixing any price-structure for eggs Advertisement has some effect, but the price limit is decided by the economics of the household, even with a product such as eggs, normally and rightly regarded as a necessity in the diet Competition with other products also arises

TABLE 1

CONSUMPTION PER HEAD IN AUSTRALIA, OF EGGS FROM ALL SOURCES, 1936 65

Year	*No of eggs per head (including eggs in shell, egg pulp, and egg powder)*
1936 7 to 1938 9 (average)	243
1946 7 to 1948-9 (average)	255
1949 50 to 1950-1 (average)	232
1951 2	219
1952-3 to 1953-4 (average)	204
1954-5	209
1955-6	205
1956-7 to 1957-8 (average)	210
1958 9	204
1959 61	212
1961-3 (average)	210*
1963 5 (average)	211–12

* Represents approximately 9 dozen from commercial and 8½ dozen from uncontrolled and back yard production

Source *Report on Consumption of Foodstuffs and Nutrients in Australia* (Bureau of Census and Statistics, Canberra) various issues

The effect of the rise in egg prices over recent years (a rise brought about mainly by marked increases in foodstuff prices, which were beyond the control of the poultry industry) may be the cause of the variation in consumption figures for Australia quoted in Table 1

It will be seen that for 1959-65 a family of three used just over one dozen eggs per week.

The home market is the best market, partly because of savings in packaging, freight, and storage and also restricted export outlets For these reasons it is necessary to extend avenues of sale for fresh home-grown eggs

EGG-PRODUCTION STATISTICS

The production for 1960-1 of eggs directly under the control of State Boards was 119 million dozen*, as compared with 120 7 million dozen for 1961-2, 110 3 million dozen for 1962-3, 111 2 million dozen for 1963-4, and 122 million dozen for 1964-5 The map in *Fig 3* illustrates the production statistics for eggs in five States for 1963-4, and also exports, from each State

In the absence of a complete census of egg production the Bureau of Census and Statistics in Canberra estimated the total production—including 90 million dozen allowance for production from uncontrolled areas and all back yard poultry keepers in the Commonwealth—as over 200 million dozen for 1963-4 This compares with an estimated prewar average for the same sources of approximately 150 million dozen annually

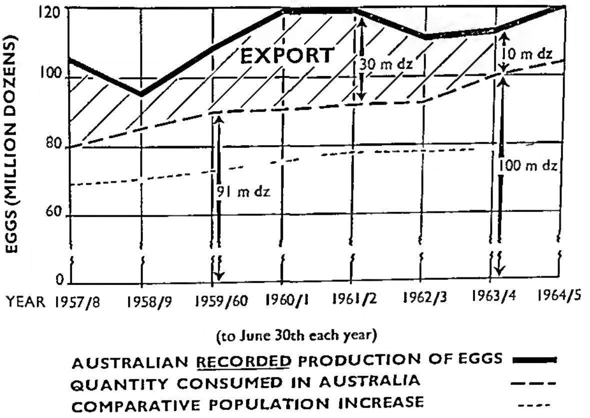
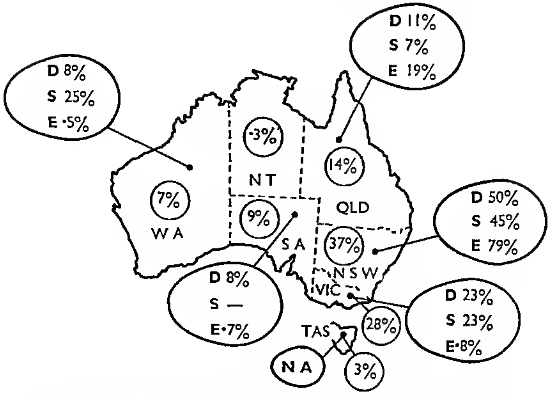


Fig 3(a) Production and consumption (from recorded sources only)

* This was made up by N S W 62 1, Victoria 28 2, Queensland 10 8, South Australia 10 5, Western Australia 7 3 millions of dozens



PERSONS IN STATE AS PERCENTAGE OF TOTAL POPULATION OF AUSTRALIA ARE SHOWN IN CIRCLES
D – DISTRIBUTION OF EGG PRODUCTION IN STATE AS PERCENTAGE OF TOTAL FOR AUSTRALIA
S = SHELL EGGS EXPORTED AS PERCENTAGE OF TOTAL FOR AUSTRALIA
E = EGG PRODUCTS EXPORTED IN FORM OF EGG PULP ETC AS PERCENTAGE OF TOTAL FOR AUSTRALIA
N A = NOT AVAILABLE

Fig 3(b) Map showing Australian egg production statistics for 1963-4

EXPORT OF EGGS

The approximate export figures for the Commonwealth are very interesting, and have a marked effect on the price-structure during the flush period of the year Export has been carried out principally to the United Kingdom, when Europe is normally experiencing its off-season

The approximate figures for 1963-4 (period ended 30th June each year) are given in Table 2 Export to all markets is quoted in terms of millions of dozens of eggs, and includes eggs in shell, egg pulp, and egg powder

The export of eggs is of considerable value to Australia; it provided a contribution to the balance of trade of approximately £3,800,000 ($7,600,000) in 1957-8, for 1958-9 £1,700,000 ($3,400,000), for 1959-60 £2,500,000 ($5,000,000), for 1960 1 £4,000,000 ($8,000,000), for 1961-2 £4,200,000 ($8,400,000), for 1962-3 £2,500,000 ($5,000,000), and for 1963-4 £1,775,000 ($3,550,000)

INDUSTRY TREND

The figures for 1963-4 production and export show that approximately 88 per cent of recorded egg production was consumed in Australia This compares with only 62 5 per cent in 1953-4 A higher egg consumption per head, coupled with the rise in population, and comparable total output, has brought this about, leaving only about 11 per cent for export

TABLE 2

APPROXIMATE TOTAL RECORDED EGG PRODUCTION AND EXPORTS 1963-4

State	*Percentage of Total Production*	*Percentage of Export as Shell Eggs*	*Percentage of Export as Egg Products*
New South Wales	50	45	79
Victoria	23	23	8
Queensland	11	7	19
South Australia	8	—	7
Western Australia	8	25	5
(*Figures for Tasmania not available*)			
Totals (*in millions of dozens*)	111 2	3 62	7 34

Source. Report of the Australian Egg Board

The Australian population is expanding at the rate of over two per cent each year. This, coupled with the increased level of egg consumption per head shown for 1963-4, indicates the possibilities of an expanding market—apart from any export

POULTRY-MEAT STATISTICS

Some figures regarding poultry-meat consumption and production may be of interest In the *Report on Food Production and the Consumption of Foodstuffs and Nutrients in Australia* the Commonwealth Bureau of Census and Statistics estimated that during the three years ended 1947-8 the consumption of poultry-meat was 10 4 pounds carcass-weight per head of population With the lifting of meat-rationing in June 1948 a reduction occurred, and the average for 1948-9 to 1959-60 was quoted as 9 7 pounds carcass-weight per head

On a population basis 1948-9 to 1959-60 average yearly consumption on this estimate can be assessed at approximately 45,000 tons of poultry meat, or considerably in excess of 20 million head of poultry, comprising principally poultry culled for age, cockerels, turkeys, ducks and geese

At the end of the 1960-4 period, leaders in the expanding poultry meat industry indicate that the figure may now be 50 per cent or more above this This could mean 15 to 16 pounds per head—with approximately half being culled for age birds The rise is due to the considerably expanded production of the specialized meat breeds, both from "franchise" operations (hatcheries integrated or linked with distribution from a central breeding source) and self contained units This is particularly evident in the Eastern States It is estimated that griller or broiler production approaches 30 million birds Improved large scale processing practices have linked to make possible lower consumer prices and increased sales

The figures published for Queensland, where recorded figures are available, indicate this marked expansion in specialized poultry meat production, with nearly 100 per cent increase shown From the production

point of view the ability to produce poultry meat cheaply depends greatly on improved efficiency of the feed. meat ratio and the price of grains and their milled by-products The improved high energy rations now being used, based primarily on U S A practice, where poultry meat production efficiency is very high, are making this possible

This has been coupled with the necessary factor of sufficient supply of suitable stock The specialized meat-purpose breeds now available, as separate meat lines, or male lines to mate with females of laying strain breeds, give stock with improved conversion results, and have made possible overall year operation These are apart from the crossbreed cockerels also used during the periods of the year that these are available Further expansion is linked with relative prices for red meat, *and* linking production efficiency with lowered processing and retailing margins The improved feeds and stock available have reduced costs, and are making possible further expansion of this side of the poultry industry—already of considerable volume and value (See also pp 466-7.)

VALUE TO AUSTRALIA OF POULTRY

The figures quoted for 1963-4 show that the Australian poultry industry in direct production value only of eggs and meat, was assessed at nearly $150,000,000 This is without allowance for the value of plant and buildings and of eggs required for scientific purposes and vaccine preparations, and without any consideration of the employment provided in the egg-case, pulp-tin, and carton-making industries, the transport and cold-storage industries, or the value of poultry in connection with the demand for grains, milled by-products, and protein meals The investment in the industry is estimated to exceed $150,000,000 and the annual bill for feed to be over $75,000,000, for more than one million tons used This includes allowance for production of eggs and meat from all sources

It can be seen that the poultry industry, in spite of the many vicissitudes suffered with egg prices and feed costs, occupies a prominent place among the primary industries of Australia

Footnote The 1959 Poultry Science Convention held in Sydney, and the 12th World's Poultry Science Congress also held in Sydney, 1962, were two very important milestones in the history of the Australian poultry industry

The 1959 Convention highlighted the application of business principles, specialization and automatic practices as needs for efficient production Improved breeding techniques, compilation of feed rations by specialists, high pullet level performance on farms, new housing approaches and improved disease-control measures were features stressed as means of placing the poultry industry on a sound footing

The holding of the 12th World's Poultry Congress in 1962 gave new status, in the eyes of the public and the world, to the Australian poultry industry. The benefits from contact with scientists and technical experts from all countries were very great indeed, and gave an exciting prospect for the incorporation of new practices covering all phases from basic husbandry to marketing techniques, with gain not only to Australia but to other countries who participated in the Congress

CHAPTER 3

SOME GENERAL AND FINANCIAL ASPECTS OF POULTRY-FARMING

THE motives that influence people to take up poultry-farming are extremely varied, but I think the main one is a desire to take part in life on the land A large number of householders keep poultry and cultivate vegetables and fruit-trees as a hobby, and they are often people whose daily work is of a clerical nature or some other type of inside work and who want to be "in touch with the land" Others are thinking chiefly of the financial aspect, and in this respect poultry-farming is attractive because the initial capital required is considerably less than for most other types of primary production but remember that usually the smaller the area of land one handles, the harder it must be worked This applies to poultry farming particularly when it comes to the question of routine attention although the work is not necessarily laborious once a plant is completely equipped and a going concern, it can be heavy in the initial stages when the unit is being built up

Sufficient capital must be provided to satisfy a minimum standard in equipment and buildings Many people get into deep water by starting poultry-farming without thought of the capital and current expenses (particularly the cost of rearing stock) to be met before sufficient returns are yielded These expenses will be itemized later

Some have begun poultry-farming in a small way, as a part-time occupation, with very limited capital, and have built up a good farm over a period of years by using the profits for further improvements, not drawing any of it for other purposes until the unit is nearly full size The labour question is one that must be seriously considered, for this is a seven day-a-week job although there is no question of being on duty all the time The work could be compared to "broken shift ' work, for although certain routine jobs must be done each day, at many periods of the year there are breaks or intervals in the routine

The question of suitability for the work must be considered, and also that of arrangements for holiday and other leave periods, which may be difficult unless worked out on a share basis Individual initiative frequently determines the size of the unit to be operated one person may have to work very hard with 1000 birds, while another will be able to handle 1800 to 2500 birds without worry—as needed with present day margins in Australia

The various sections of the poultry industry will be discussed later, but its main purpose is the production of eggs Unless this is profitable other avenues of specialization cannot be sound success in poultry keeping must be measured by the existence of a payable margin over costs in egg production Activities should not be spread too widely specialization brings about greater efficiency and higher returns, and enables more birds

to be handled Intelligent planning of the lay-out and routine is the first and most important requirement for success (see p 42)

A person sometimes decides to take up poultry-farming with the idea of reducing family living-expenses a family living on and running their own poultry-farm can live comparatively cheaply, for there is no expense or time involved in travelling to and from work, clothing can be simpler and consequently less expensive, and a home supply of eggs and poultry keeps the food-bills down

ESTABLISHING A COMMERCIAL UNIT

Location and Land Features

One of the first points to consider in establishing a commercial poultry unit is the location of the farm Certain areas may appeal, but high cost of land or lack of services may be deterrents Land can be too cheap for poultry-farming the idea that anything will do for poultry is reprehensible, and when the land is very cheap you should look for the possibility of a "nigger in the wood pile" and make careful inquiries into the reasons for its cheapness Is the site far removed from transport facilities, or not connected by a road passable in all seasons? Does it lack water—could a bore be put down or would catchment be the only supply? Is the soil suitable for cultivation of green crops? Is the land subject to flooding, heavy rainfall, or continual fogs and damp most of the year, or is it in an exceptionally dry area? Is it too hilly for convenient working? Is it in a windswept position? Is it liable to bushfire hazard? Is it far removed from the market for eggs and stock, without the compensating factor of being close to a source of feed, particularly grain? Will the supply of feed be difficult because of costly haulage over long distances? Some but not all of these disabilities can be overcome

Transport

The transport of food, equipment, and eggs is a considerable item during the year For every thousand birds and annual replacements on a unit, apart from all the building materials in the first instance, an average of approximately 50 tons of feed, 9 tons of eggs, and 1 ton of cull birds will have to be transported each year This means with other incidentals such as fuel and maintenance replacements, approximately 1½ tons per week This does not allow for moving the 25 to 30 tons of manure available annually from 1000 birds—a sideline whose value depends on proximity to a suitable market (well handled, this by-product can be valuable, particularly from a deep litter unit) Regular transport facilities are essential Some will immediately think in terms of a truck to do the work, but careful consideration should be given to this question: the turnover on a poultry-farm of one-man size is hardly enough (particularly during the establishment stage) to warrant the heavy capital expense of purchasing such a vehicle. it would normally be used on only one day a week, and the poultryman would be away on that day. An efficient carrying service could supply transport for the smaller poultry-farm, and this would prove much less costly than over-capitalizing plant and using time that would be more profitably employed on the farm

A utility van is a useful possession, but the small poultry-farmer would still have to leave his property for a day each week in order to make the best use of it, taking his produce to market The possession of a car is a private family matter that has no bearing on this subject

Water

An adequate water-supply of reasonably good quality is essential One thousand birds can drink up to 50 gallons a day, and after allowing for non-irrigation during the winter months a daily average of 1000 gallons of water can be used in the production of greenfeed If lucerne meal or substitutes are used, a smaller quantity of water will be needed More will be said on this question later, but healthy stock, lower feed-consumption, and a quality egg for the consumer cannot be obtained without the provision of ample greenfeed—in either wet or cured form Poultry-farms as well as farms of other types have found greenfeed both essential and a valuable safeguard against high feed costs, and it has proved particularly valuable in periods of economic depression or in droughts The quality of the soil for growing greenfeed sometimes needs to be improved, and much can be done with it if the land is not too rocky or steep The Department of Agriculture in each State will give advice on soil problems Alternatively lucerne meal is purchased and included in the feed

Laid-on water or suitable well- or bore-water is a primary necessity, for summer irrigation must be taken into account, as well as water for drinking purposes and for cooling down the sheds and the birds in heat-wave periods

Size and Cost of Land

The cost of land for a poultry-farm is generally lower than that for a building-block in a suburban area, unless the unit is a highly concentrated one The aim should be to secure reasonably priced land offering as many facilities as possible It would be desirable to have two or three acres for each 1000 birds, but farms as small as half an acre are efficient for 1500 to 2500 birds Much depends on the system adopted—whether intensive, semi-intensive, or free-range

Electric Power and Mechanical Plant

Electric power is a great help in the operation of a poultry-farm, particularly if later expansion of the unit is planned Power machinery is not usual on sideline units, but on a large commercial farm, feed-mixing, grain-crushing and water-pumping machines, power grass-cutters, rotary hoes, large feed-bins or silos may be needed Such mechanical equipment reduces labour requirements, but it is out of the question when capital is limited and the unit is small

Given other good facilities, a farm can be worked successfully without power, though every endeavour should be made to provide it

Modern domestic amenities for the farmhouse are also very desirable and can contribute much towards the success of a poultry-farm

Fig. 4. An attractive residence and outbuildings on an established poultry-farm, with a wide drive dividing the property, allowing easy vehicle access to all buildings.

Proximity to Market and Feed-supplies

The greater the distance from the market, whether in the city or in a large country town, the higher are the transport costs for the eggs, feed, and poultry, though these costs are offset in some of the remoter districts by the availability of cheaper grain. "Mill-door" prices often prevail in country areas, and this is a point to be considered when choosing a suitable property for poultry-farming.

Personal Qualities of the Poultry-farmer

The personal qualities necessary for successful poultry-farming are not the least of the factors to be considered. The capacity for meeting routine obligations, as well as a general aptitude and liking for poultry-farming, are important requirements, but there are others too. (A liking for poultry-farming does not mean that a man must love the birds—he must have a liking for the type of life—though a liking for the birds will be a great advantage too, it need hardly be said.)

A basic requirement is a sound knowledge of poultry husbandry, and since it is hoped that this book will be of special assistance in this regard, the recommendations made should be carefully studied. "Trial and error" was a necessary part of the development of the Australian poultry industry, but nowadays this process is no longer justified and orthodox procedure should be adopted. A poultryman who successfully operates a large farm is really a professional man: his knowledge is acquired from long experience combined with study, and he must be able to adapt himself to many other occupations, such as building and general farming, and should also

be a handyman, particularly if he is running a one-man or family unit Even on the very large plants the owner's knowledge of all these things will be needed if he is to direct his employees efficiently Good management is the most important factor in successful poultry-farming It is the man that counts, and a farm fully equipped with modern equipment will be a failure if the poultryman himself has not the necessary qualities Another point to be remembered is that it will be difficult to obtain capital to start a poultry unit if you cannot demonstrate some or all of the qualities I have mentioned

Study of Improvements in Efficiency

The question of study has been mentioned this is essential if the poultry farmer is to benefit by improved methods But do not rush after every new idea just because it is new—do not depart from a proven practice that is giving good results unless someone else can show you a better one of a genuine, proved nature

Fig 5 Field-day at Hawkesbury Agricultural College New South Wales where visitors are shown inspecting a mechanical feeder

days, either at State experimental centres or on private farms, have a considerable value there one can learn something of the methods and problems of other poultrymen and benefit by new ideas no matter how long one may have kept poultry there is always more to be learnt, and many poultrymen have evolved ideas that will benefit others as well as themselves

If there is anything wrong with your poultry that you cannot diagnose, do not waste time in trying to discover what it is yourself In the case of disease, particularly, you should obtain advice without delay, either from a specialist in poultry diseases in your area or from the State Department of Agriculture

SIZE OF UNIT

A 1000-bird plant used to be regarded as the minimum size necessary to provide a living, but today this would not provide an adequate return Lowered prices for eggs and high prices for feed, which reduce the profit margin per bird, mean running more birds on the unit combined with lower numbers in each pen, or perhaps varying the culling, feeding, and breeding methods Seven hundred and fifty birds efficiently handled in 12 bird pens have been seen to produce as many eggs as 900 birds in 100-bird pens, or as 1100 birds kept in one large flock A practice that leads to greater efficiency is to increase the percentage of pullets kept on the farm (see pp 95-6 for a discussion of this) When you are considering ways of promoting efficiency keep in mind that Nature does not like crowds The number of birds is not the sole criterion of an efficient farm the production from each bird is the important thing A one-man farm must be efficient on a "per bird" basis—on the other hand, a very large farm viewed as a big business can operate successfully with a lower profit per bird, on the principle of smaller profits and large turnover

The type of housing and the lay-out and equipment within the sheds will help to determine the size of the unit Some efficient poultry-keepers handle 2500 birds, others try to operate with only 1200, but 1800 to 2500 could be taken as a good figure for a well-laid out one-man plant with proper facilities If expansion is envisaged, remember that for 3500 to 4500 birds you should have one full-time employee (i e a two-man farm), around 5000 to 6000 birds would be economically sound for a three-man farm run for egg production alone These ratios of number of stock to number of operators cover all the poultry-farm operations such as rearing, egg-packing, egg-grading, and maintenance, but not stock sales or hatchery operations for outside supply, when the labour would need to be increased

The type of market sales (whether wholesale to the normal egg-floor or, as carried out in several States under what is known as the "permit" system, direct farm sales to the public) will influence the decision regarding the number of birds needed by a poultry-farmer for a reasonable living

ESTABLISHMENT COSTS PER 1000 BIRDS ON A UNIT

The cost of establishment is usually the deciding factor in the foundation of a poultry unit. In this section estimated costs of establishing n 1000-bird

FARM B

Semi-intensive laying sheds Range-rearing system for the young stock Materials only, exclusive of any labour, erection costs, or house and land

Materials needed (approx) for each 1000 birds	*Costs (approx —check for local variations)*	
1 6 tons galvanized corrugated iron	if $150 per ton Aust	$900
or		*or*
1400 sq yds coverage asbestos	if 50c per sq yd average flat and corrugated	$700
2 4000 super ft softwood, 1000 super ft hardwood	if $10 per 100 super ft, average	500
3 2000 yds netting 48″ x 2″, or 1000 yds 72″ x 2″	if 20c per yd	200
4 1200 super ft timber for yard posts	if $12 per 100 super ft	150
5 1000 ft ½″ and ¾″ water-piping		100
6 Incidentals		250
		$1900 to $2100

Note If cement floors are required estimate 7 to 8 loads screenings, 7 to 8 loads sand, and 150 to 200 bags cement (Aust) $250

$2150 to $2350

FARM C

Fully intensive laying sheds, with range-rearing system for young stock Materials only, exclusive of any labour, erection costs, or house and land

Materials needed (approx) for each 1000 birds	*Costs (approx —check for local variations)*	
1 7 tons 26 galvanized corrugated iron	if $150 per ton Aust	$1000
or		or
1600 sq yds covering such as asbestos	if 50c per sq yd average flat and corrugated	$800
2 4500 super ft softwood, 1200 super ft hardwood	if $10 per 100 super ft average	600
3 1000 yds netting 48″ x 2″, or 500 yds 72″ x 2″	if 20c per yd	100
4 600 super ft timber for yard posts	if $12 per 100 super ft	80
5 1000 ft ½″ and ¾″ water piping		100
6 Incidentals		300
		$1980 to $2180

Note If cement floors are required estimate 8 to 9 loads screenings, 8 to 9 loads sand, and 175 to 225 bags cement (Aust) $300

$2280 to $2480

FARM D

Intensive rearing of young stock and housing of layers, employing deep-litter system for all ages Materials only, exclusive of any labour, erection costs, or house and land (These costs *may* apply for a cage unit also)

Materials needed (approx) for each 1000 birds	*Costs (approx —check for local variations)*	
1 10½ tons 26 galvanized corrugated-iron	if S150 per ton Aust	S1600
or		*or*
2400 sq yds covering, such as asbestos	if 50c per sq yd average flat and corrugated	S1200
2 9000 super ft softwood 2000 super ft hardwood	if S10 per 100 super ft	1100
3 100 yds netting 48" x 2" (divisions)	if 20c per yd	20
4 1000 yds ½" and ¾" piping (with greenfeed area)		100
5 Incidentals		400
		$2820 to $3220
Note If cement floors are required estimate 12 loads sand, 12 loads screenings, and 300 bags cement (Aust)		$480
		$3300 to $3700

Note especially that the costs shown are for materials only other costs are covered in subsequent chapters If the sheds are built by contract instead of being erected by the poultry-farmer himself, an increase of 50 to 100 per cent may have to be allowed on these figures This could mean that the ultimate cost of Farm A would be S2200 to S3000 and of Farm D S5000 to S7500 per 1000 birds

The cost of the land is difficult to estimate, for it depends to a large extent on the location, and the cost of the house is also difficult to estimate, being a matter for individual consideration—and in any case a house would be required, whether the person concerned was starting poultry-farming or not Possibly $4500 to $5000 for the house and land might be a *minimum* allowance for a reasonably good area This can be added to the estimates quoted above, so that the poultry farm—according to the type and whether erected by the poultryman or by contract—could cost from S6000 for Farm A to S12,000 for Farm D This excludes the cost of raising the stock and capital reserve Approximately $1800 is suggested for these two items, so that between S8000 and S14,000 could be the approximate cost-range for the varying types of farms per 1000 layers, including house, land, stocking, and erection of sheds by contract (These figures allow S1500 and S3700 respectively for contract erection) If a battery or cage laying system were adopted on the farm, then the cost per bird could be increased by approximately the cost of the batteries, *but* with modern sawtooth-design units, rearing quarters included, the cost may not exceed Farm D Refer to p 59 for further information

Stocking Costs

The various methods of stocking a plant are discussed in detail in another chapter, but it is necessary to give an idea in this section of the cost of stocking a 1000 bird unit, since many people do not make sufficient allowance for the expense incurred in raising pullets to laying stage

The price of day-old pullets varies somewhat between States. but it is necessary to adopt an average, and 25c. to 30c. per head ($25 to $30 per 100 day-old pullets) is suggested. If the pullets are reared on range they will consume at least 20 to 22 pounds of feed per head and if reared under more intensive conditions they may consume 25 to 27 pounds per head. Thus every hundred pullets will require 1 to 1¼ tons (2000 lb. =short ton) of foodstuffs until just on six months of age: at 2c. per pound, or $50 per ton, for feed, this will cost from 50c. to 68c. per head (according to the rearing system used), plus the day-old price of 25c. to 30c. Therefore, 75c. to $1 per head must be allowed. This means capital investment in the first instance; after establishment the item is included as current expenditure balanced against cull returns, but it means outgoing money with no prospect of returns until the birds become productive. One thousand dollars should therefore be allowed for 1000 pullets if feed costs 2c. per pound ($50 per ton).

If you purchase a sound plant as a going concern, with adequate replacement stock on hand, then apart from the purchase price for house, land, sheds, laying stock, and plant, an amount must be set aside for goodwill—since there is no waiting period for productivity. Assessment of goodwill value can be based on the cost of raising young stock (see the above figures) and also on an appraisal of capital reserve.

Capital Reserve

It is not sufficient to allow only for such known factors as have been outlined. Setbacks may occur—a brooding accident or storm damage or some other happening—for which allowance must be made, and for this $240 to $300 is suggested. It should not be less than $240. Careful consideration has also to be given to the question of living-expenses until the farm is productive. If a farm is started in the springtime and everything goes according to schedule, it will be at least six months before part returns

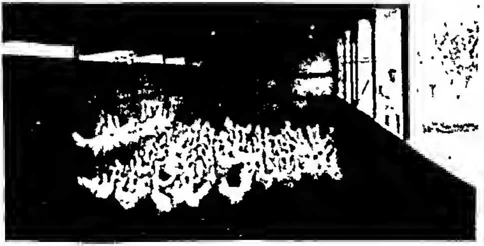


Fig. 6. Well-grown, spring-hatched pullets housed at laying stage. Note internal equipment features of a well-built, intensive laying shed, with sufficient nesting accommodation and good deep litter. Electric lights are used for increasing winter production, particularly with large groups of pullets.

begin to come in If circumstances make it necessary to begin earlier, then another two or three months may have to be allowed—hence, living-expenses for at least six months, and possibly more, must be provided for Even at the low figure of $15 per week (living being cheaper on a farm) this would mean providing $360 for six months, and it would really be advisable to set this figure 50 per cent higher. A total reserve of $600 to $800 should therefore be allowed in addition to the investment cost and the cost of the stock

Total Investment

To arrive at the total investment for a 1000-bird unit we have to consider all the costs previously outlined A suggested cost covering Farm C will be given Any increase or decrease on these figures can be assessed by referring to the different cost of plant shown for Farms A, B, and D Cost of stock and of rearing would not vary greatly for any of the farms, and house and land costs are governed by the locality and the type of farm adopted—whether intensive or open-range

APPROXIMATE COSTS FOR EACH 1000 BIRDS ON FARM TYPE C, WITH INTENSIVE LAYING-SHEDS, AND REPLACEMENT STOCK REARED ON A FREE-RANGE SYSTEM

Materials	
Laying-sheds	$1000
Egg-room, brooding-shed, feed-shed	420
Rearing-sheds and -yards	200
Brooding equipment	80
Piping, water system, tools, and incidentals	400
Cement floors	300
	$2400
Stock and Reserve	
Day-old pullets for one or two seasons (approx 1100 purchased)	$300
Feeding cost for raising pullets (with feed at 2c per pound)	800
Reserve for accidents and for living expenses until part returns commence	700
	$1800

This gives a total of $4200 for cost of materials, stock, and reserve and with the erection of the plant by the poultry keeper ($1200 to $2400 extra should be allowed if erected by contract, making a total of $5400 to $6600 per 1000 layers) This amount excludes house and land, for which the allowance might be, as stated previously, between $4500 and $5000 This could mean a total of $9000 for this type of farm if erected by the poultry-keeper, or up to $11,600 if erected by contract

Variations can be worked out for units of types A, B, or D by adjusting

the prices given for materials Farm A could be approximately $1000 less, Farm B, $400 less, and Farm D, $1200 more if erected by the poultryman If erected by contract, Farm A could be $1800 less, Farm B, $800 less, and Farm D, $2400 more than the cost of Farm C These figures indicate an investment range of $3 to $9 per bird for farm units

EXPENSES AND RETURNS AFTER ESTABLISHMENT

The main variation in costs will be due to feed prices Poultry-farming is primarily a matter of conversion of one food into another—eggs or meat—and the efficiency of the process is largely determined by the genetic make-up and age of the birds, combined with the poultry-farmer's knowledge and his application of good husbandry principles

Cost of Feeding a Laying Bird

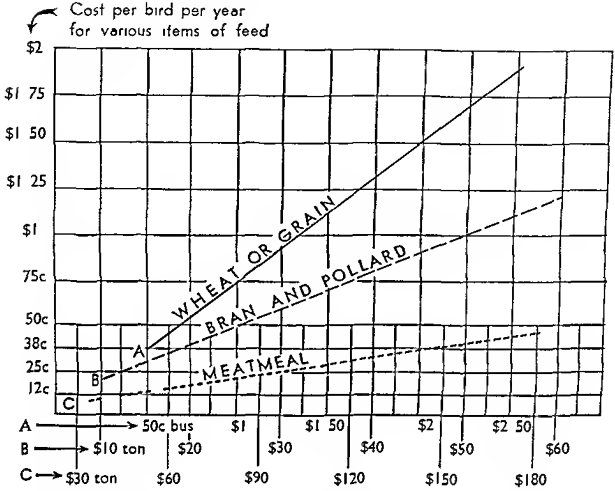
The food consumption figure per normal-sized laying bird that has generally been taken as an average basis (both in Australia and overseas) is 90 pounds of all feeds, exclusive of greenfeed, per year Variations of this figure do occur, and under free-choice feeding systems it may be exceeded to a considerable degree, but for medium sized layers 90 pounds of feed will give very efficient results when a correctly balanced ration containing sufficient protein and normal basic ingredients is given, combined with good husbandry in other respects It is not economic to obtain high production figures with high food consumption, it is necessary that the conversion ratio be an efficient one, which means that 5 to 7 pounds of feed should produce one dozen eggs according to energy/protein ratio

A common feeding basis has been 50 per cent of mash composed mainly of bran and pollard and protein concentrates, combined with 50 per cent of grain This has been replaced widely in the industry by rations composed of grains only, because of their higher energy content, and their greater efficiency in relation to average ruling costs for mill offals In Chapter 14 on feeding various examples are given and methods of assessing for comparative values outlined Their efficient use can bring feed consumption under 5 lb per dozen eggs, and feed used below 90 lb per bird per year—when these are of reasonable body size

Figure 7 shows the method of calculating the cost of feeding a laying bird for a year, using 45 lb of mash (40 lb of bran and pollard and 5 lb. of meatmeal) and 45 lb of grain Adjustment can easily and accurately be made for any prices of bran, pollard, grain, or protein Prices of various foodstuffs are published in newspapers regularly, and averages for twelve-month periods are usually available from the Department of Agriculture, based on egg-laying competition results and price-trends

The explanation of the graph given in Fig 7 is as follows·

1. The cost of feeding a bird with 90 lb of foodstuffs per year, made up of 45 lb of grain, 40 lb of bran and pollard, and 5 lb of meatmeal, can be obtained for varying prices of foodstuffs on a "ready-reckoner" basis by adding together the figures obtained for A, B, and C. This is calculated for each item by taking the price per bushel or ton for the item required, then



KEY A—Grain per bird on 45 lb basis Basic cost shown per 60 lb grain

B—Bran and pollard per bird per year on 40 lb basis Basic cost shown per short ton (2000 lb)

C—Meatmeal or protein per bird per year on 5 lb basis Basic cost per short ton

Fig 7 Feeding costs graph for use as a ready reckoner

moving straight up the graph until the appropriate line is reached, and then straight across to the cost per bird per year (or approximately 350 birds per day)

2 If it is desired to use the graph for different weights of any of the ingredients per bird—for example, 90 lb of wheat or crushed grain for a high energy ration instead of bran and pollard—then double the figure for A If required for 60 lb of grain and crushed grain and 25 lb of bran and pollard, then increase or decrease each item in proportion namely A plus $\frac{1}{3}$ and $\frac{5}{8}$ of B, and so on Increased protein can be calculated in similar fashion The cost of a higher food-consumption per bird can be worked out in the same manner

3 The cost of raising young stock can be worked out on the basis of one quarter of the feed consumed by a laying bird in a year, for the quantity normally required to raise a bird to six months would be approximately 22½ lb

4 As an example, the cost of feeding a bird with wheat at $1 50 per bushel,

bran and pollard at $40 a ton, and meatmeal at $60 per ton would be $1.12 plus 80c. plus 15c., that is $2.07 to feed a layer for twelve months (without allowance for straw for litter, and for shell-grit and hard-grit). In this case the cost of the feed for raising a pullet would be approximately 55c.

Cost of Replacing Laying Stock

The short period of high-level production of poultry means a high wastage factor and as a result it has been considered that two years' laying is the normal limit of commercial production. There is an increasing tendency to concentrate on first-year production only as a means of maintaining the highest possible flock average, and this is good practice. It means that the stock on a poultry-farm has to be turned over (or replaced) in either twelve months or two years (depending on the system used).

The economics of the varying replacement percentages of stock are discussed in Chapter 7.

The first year of farm operations means capital investment in young stock (previously referred to), and in the first year the laying results obtained are the same as on an all-pullet farm. In the second year the poultryman, whether part-time or full-time, has to decide which practice he will adopt in relation to stock replacement each year. He will be guided by the following considerations:

1. The price of day-old pullets, and the cost of feed and labour needed to rear them to laying age.

2. The comparative price obtainable for birds to be culled at the end of the first year and the second year, and the estimated mortality among the adult stock over the two-year period.

These costs will then be considered against the returns from increased lay from pullets, after assessing the egg-size factor also.

We shall consider an example given on a basis of 50 per cent (the minimum) replacement (see Chapter 7 for the returns resulting from 75 per cent replacement of laying stock or 100 per cent replacement).

1. Take 25c. to 30c. ($25 to $30 per hundred) as the cost of a day-old pullet. For a farmer specializing in straight egg production it is an economic proposition to purchase the annual stock requirements, provided he can obtain these from a reliable source (where the parent stock are blood-tested breeders bred from a good production-line). It is a good practice to purchase stock annually because (*a*) chickens are obtainable in one or two lots, thus reducing rearing labour; (*b*) there is no need to take on breeding operations, and this allows the carrying of more stock; and (*c*) the chickens are obtainable at the right time of the year and over a short period.

It is not advisable for the owner of a small poultry unit to branch out into more than one operation, and it is very necessary for the well-being of the industry that those qualified to carry out breeding should concentrate on such work, for it is the backbone of an efficient poultry industry. (Later on, when his small unit has grown the poultryman may combine stud breeding with stock distribution, and it could be an economic practice.)

2 The cost of rearing stock is governed by the cost of foodstuffs, and a figure can be arrived at by referring to the costing graph (see p 25) Provided efficient rearing methods are used—with an ample range and good pasture, plus a sound feeding system—a pullet can be raised on a quarter of the feed allowed for a laying bird annually With grain at S1 50 for 60 lb , bran and pollard S40 per ton, and protein S120 per ton (including allowance for milk products) and using a quarter of the quantity in each case, the rearing cost would be (see Fig 7)

A	B	C	
28c	+ 20c	+ 8c	= 56c

Day-old cost plus rearing cost would total 81c to 86c With intensive rearing the quantity of food required might be increased by up to 25 per cent, with a corresponding rise in the cost This could mean approximately 20c extra, giving a total figure of around S1 for raising one bird (there is no allowance here for mortality) Local variations in feed prices are easily taken into account when working out rearing costs by means of the graph

The replacement cost to be debited against a layer on the farm (once the farm is established) is arrived at by checking the rearing cost of a pullet against the amount received for a culled bird If a price equal to that of buying and raising the pullet can be obtained, then no debit will be incurred except for mortality For example

(*a*) If 500 pullets are raised at S1 and 400 second year birds were sold at S1 each from 500 laying pullets originally (working on the conservative basis of approximately 10 per cent mortality in each of the two adult years), then 100 pullets at S1 would be raised without any compensating cull sales This would mean a debit of ten cents per head per 1000 layers, although the price for culls, bird for bird, equalled that of raising a pullet

(*b*) If the price of culls was only 60c per head an additional debit of 400 x 40c would be incurred of just over 15c per head on a 1000 bird unit This would result in a total debit of 25c per head

Further data on this question as related to the all pullet farm is given in Chapter 7

Working Charges and Maintenance

Any business with a large turnover will inevitably have overhead and working expenses of some magnitude, and since every thousand laying birds can produce eggs of a gross value exceeding S5000 a year—based on price levels in recent periods—the overheads on a poultry farm will not be small Some of the working items that must be allowed for are power, water charges (either for water from the main or for pumping expenses on the farm), maintenance of equipment, sundry repairs, cost of preventing disease (for example, vaccination against fowl pox, deworming of young stock)

Power and water charges will vary according to the locality Maintenance costs will depend to a great extent on the standard of workmanship and the materials used in the plant when it was erected A hastily built plant made from poor materials will need more maintenance work

than a well-constructed farm made of good materials. An allowance of approximately $6 a week should be made for the various working charges and depreciation, plus interest on capital. Depreciation must be provided for or a farm cannot operate successfully on long term basis.

Total Expenses per Bird

Total expenses per bird can be arrived at by taking the feeding cost ($2.07 in the example given on p. 26), to which a small allowance—say, 14c.—should be added for shell-grit, hard-grit, and straw. Then add a possible debit of up to 25c. per bird for the replacement cost, and up to 30c. per bird for working expenses and maintenance.

The total, in this case, would be approximately $2.76 per bird per year, or nearly $54 per week per 1000 layers. This is only approximate because of variations in the different States for feed, prices, cull returns, and working expenses, which make it impossible to be accurate. With a knowledge of local costs the basis given for calculation makes it an easy matter to arrive at the correct figure with reasonable accuracy.

Returns from Egg Production

The returns on poultry-farms where egg production only is carried out are mainly dependent upon the price received for market eggs, for on these farms cull sales and manure sales are only small sidelines. The average net price for the year is the only correct basis on which to work out returns—it is not correct to take the wholesale price of eggs quoted in the newspapers as a figure for calculation.

The variation of prices between spring, the peak production season, and winter, the off-season, can be considerable. The average is worked out from the numbers produced at all seasons of the year, so the aim must be to produce as many as possible during the difficult off-months; it is in these months that local egg-sales reach their highest peak for the year, for consumption levels rise in cool weather, when there is a low level of production in backyard units, and demand exceeds supply. This situation creates a major problem for marketing organizations. More than sufficient eggs are available in the spring months, when home-market purchases are low.

The deductions made from the wholesale price must be allowed for (this is normal procedure in the conduct of any business). Grading and handling operations have to be paid for at award rates, and clerical work on payments and receivals is necessary, as in any business. A levy is usually made through Egg Boards to enable them to equalize the market variations and thus stabilize the price of eggs. The fairest way of assessing these amounts is to calculate them as a percentage of the price paid.

In comparing the present price of eggs and that of a previous year it is necessary to take into consideration the changed wages and grain prices. For example, the basic wage in Australia of about £5 10s. ($10.50) in 1947 compared with about £17 ($34) in 1965 would indicate an increase in handling costs. The difference between the cost of wheat in 1947 and 1965 —it was approximately 5s. 6d. (55c.) per bushel in 1947 and 17s. 6d. ($1.75) in 1965—would obviously also have a very marked effect on the

price of eggs (The wheat prices quoted refer to the average prices paid by poultry-keepers plus an average allowance for freight charges)

In addition to the charges listed made by marketing authorities covering bird levies or deductions, grading, and commission, allowance must be made for freight—a matter for local assessment—and for "down-grading" (relegation to second grade) The latter can become a considerable item, but for an efficient farm within reasonable distance of market a normal amount might be 1½c to 2c per dozen averaged over twelve months Causes of eggs being down-graded are spider cracks, stains, fractured air-cells, bloodspots, and germination Others are conditions of the yolk or of the white occurring in hot weather or at the end of the laying season—green yolks, floating yolks, and so on On a well-run commercial unit where correct husbandry practices prevail 90 to 95 per cent of the eggs marketed over the year qualify as first-grade hen eggs

The total amounts of deduction vary from State to State, and also for the different periods of the year, and the most reliable way to assess returns from poultry is to work on an average net price (based on the price-trends of recent periods) and on the calculations covered in this section

Flock Average

The number of eggs obtained per bird is calculated from the flock average on the farm A reasonably efficient farm working with 50 per cent pullets and 50 per cent second-year birds formerly had a 12-dozen flock average. With very good husbandry methods and a higher percentage of pullets (or all pullets), this egg-production level has been increased by up to 25 or 33 per cent—that is, to an average of 15 or 16 dozen The method of calculation is shown in Fig 8, which enables the return per bird for varying levels of production and egg prices to be worked out For 1964-5 period it required over 100 eggs to cover annual feed costs per layer, compared with only 65 being needed fifteen years ago This shows the need for a high level of pullets, which can lay 45 to 50 eggs more than a second-year bird

With eggs at 35c per dozen, the cost of feed $3, and a production average of 15 dozen, the profit and labour margin would be 15c per dozen The cost-of-production basis with any feed cost or rate of lay can be calculated by moving straight up the graph from the production figure selected until the appropriate feed-cost line is reached, then straight across to the average price of eggs for the feeding cost per dozen eggs

Assessment can be made of the increased margin available when the flock average is increased For example, a 12-dozen flock average increased to a 14-dozen one means a reduction in feeding costs from 25c to 21c per dozen, or approximately 4c lower cost per dozen—when the price of feed for each bird totals $3 per year Then for each 1000 layers, with eggs at 35c. per dozen net, there would be an increase in the return to the farmer of nearly $14 per week

In assessing returns from a farm with a 15-dozen flock average remember that every 1c per dozen means 12c per bird per year, which is approximately $2 50 per week for each 1000 layers This would mean that with

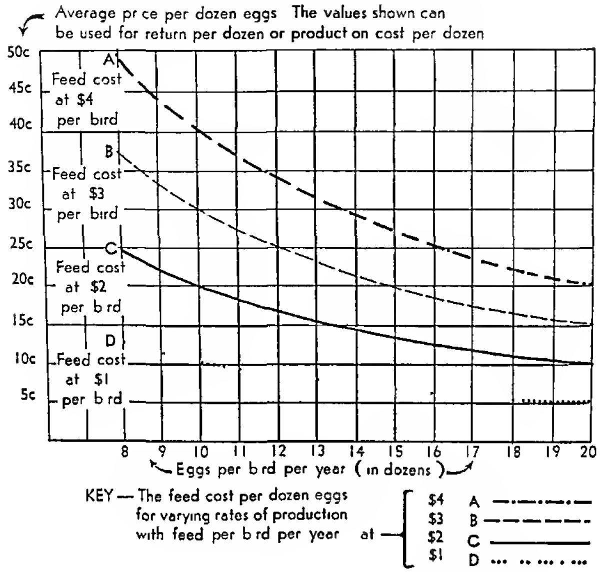


Fig 8 Production costs graph to show returns for varying prices

1000 layers and a net price of 30c per dozen for all eggs, gross revenue would average $84 per week, with eggs at 35c per dozen net, gross revenue would average $100 per week If this is considered in conjunction with the figure previously cited as an example of costs (namely, $54 per week for 1000 birds), a margin to labour, management and return on capital of $1 50 to $2 30 per bird (or approximately $30 and $46 weekly respectively per 1000 birds) is indicated The effect of the movement of a few pence per dozen on aggregate returns can be readily seen, also the effect alterations in feed prices or an increased rate of lay would have on costs These figures are increased or decreased through the sale of cull birds at higher or lower prices, also by sales of poultry manure or of bags

Statistical information on yearly trends in egg prices is usually available in publications of the Commonwealth Department of Commerce and Agriculture, from the State Departments of Agriculture, or from the State Egg Boards These prices can be applied to the graphs to ascertain the margins over the cost of feed

As a further guide, some figures based on the graph in Fig 8 are given in Table 3:

TABLE 3

SAMPLE COSTS AND RETURNS

(*Based on Fig 8*)

Feed costs and rate of production	*With eggs at 25c a doz net*		*With eggs at 30c a doz net*		*With eggs at 35c a doz net*		*With eggs at 40c a doz net*	
	Returns	*Labour margin per bird over costs*	*Returns*	*Labour margin per bird over costs*	*Returns*	*Labour margin per bird over costs*	*Returns*	*Labour margin per bird over costs*
Two dollars feed cost per bird per year or all expenses per bird—								
12 dozen	$3	$1	$3 60	$1 60	$4 20	$2 20	$4 80	$2 80
14 dozen	$3 50	$1 50	$4 20	$2 20	$4 90	$2 90	$5 60	$3 60
16 dozen	$4	$2	$4 80	$2 80	$5 60	$3 60	$6 40	$4 40
Three dollars feed cost per bird per year or all expenses per bird—								
12 dozen	$3	Nil	$3 60	60c	$4 20	$1 20	$4 80	$1 80
14 dozen	$3 50	50c	$4 20	$1 20	$4 90	$1 90	$5 60	$2 60
16 dozen	$4	$1	$4 80	$1 80	$5 60	$2 60	$6 40	$3 40
Four dollars feed cost per bird per year or all expenses per bird—								
12 dozen	$3	—$1	$3 60	—40c	$4 20	20c	$4 80	80c
14 dozen	$3 50	—50c	$4 20	20c	$4 90	90c	$5 60	$1 60
16 dozen	$4	—	$4 80	80c	$5 60	$1 60	$6 40	$2 40

In Fig 9 an example of expenses and returns is given Feeding costs, replacement cost, and working expenses per bird are taken as $2 75 and the average net price for eggs is taken as 38c per dozen, a low annual flock average of 12 dozen eggs is assumed The figure shows the proportion of returns taken, the various expenses, and the balance available for labour and management All these figures are based on costs discussed in this chapter Refer to the text, the two graphs (Figs 7 and 8), and the concluding table for the basis of calculation, taking into account variations in feed costs, production level of eggs per bird per year, and egg prices received The expenses and returns per bird in this example show that nearly two-fifths of the gross return is for labour and management and that feed is approximately 75 per cent of costs apart from labour

Sample Balance Sheet

An example of a balance sheet will now be given Use is made of some of the costs illustrated in the graphs in this chapter and of some of the

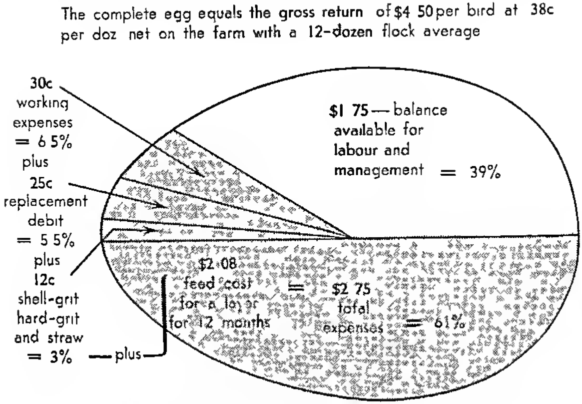


Fig 9 The egg and how it is apportioned for various costs—could also apply for 15 dozen eggs at 30c per dozen

cost examples in Chapter 7 Adjustment can be made for variations in cost of feed, rate of lay per bird, cull or egg prices received Figures used in this balance sheet follow recent trends in costs and returns

Suppose the farm has 1500 layers with 66 to 75 per cent pullets, is run by efficient methods, and obtains an average production of 15 dozen eggs

Costs		*Returns*	
Purchasing 1250 day old pullets, and raising 1125 at approximately $1 10 each (allowing for reasonable mortality) .	$1250	Sale of eggs from approx 1500 layers with 15 dozen production rate = 22,500 dozen at 33c per dozen net on farm	$7500
Feeding costs for approx 1500 layers at $2 70 per bird (based on the average number of stock for the year)	4000	800 cull birds at 60c (after mortality losses when starting with 1250 each year)—number for sale may be higher	480
General working expenses at 20c per bird	300	Sales of manure	340
Interest and depreciation on general plant at 30c per bird	450		
	$6000		$8320

Balance for labour, management and return to capital, after depreciation and interest allowance of $450 .. $2320

per bird, with low mortality in rearing and among adult stock The price of eggs is taken at 33c per dozen net, the cost of raising a pullet at $1 10, and the return for a cull bird at 60c Feeding cost is taken as $2 70 per bird per year, working expenses 20c per bird, and interest and depreciation allowance 30c per bird For capital costs refer to Chapters 3 and 4

All costs are given on a "per bird" basis to enable calculation to be made for a sideline unit For example, one-third of costs and returns shown would apply for a 500-bird sideline unit

SUMMARY

1 Motives for taking up poultry-farming are considered A sound knowledge of good husbandry and an open mind on study of new methods are indicated as necessary The importance of sufficient capital for the type of unit desired is stressed and the planning of a farm is discussed

2 Location of the farm is important Carefully check the various points mentioned, all of them are important for the successful running of a poultry unit

3 The unit must carry enough stock to make the project efficient in the use of labour and obtain a high output per bird The number of birds suggested for commercial plants is a range of 1800 to 2500 birds per man, and this ratio would apply to combined operations on the poultry-farm, including maintenance, the rearing of replacement stock and the collection, grading, and packing of eggs

4 Check prevailing feed costs and egg prices against the costs and returns graphs, to ascertain the likely margin available on an efficient plant The costs items on the graphs and tables can be used as examples of feed or of feed plus all other costs Returns for eggs should be based on twelve-month averages In particular winter price-levels should be watched Also refer to Chapter 17

5 The size of margins over costs in poultry-farming depends on the efficiency of the operator, the rate of lay of the stock, and the lay-out and size of the plant

6 The costing basis given can also be applied to a poultry unit which is in operation Further, a combination of points 3 and 5, for stock numbers and rate of lay, indicates that 25,000 to 30,000 dozen output from a one-man unit, when obtained from the lowest possible number of layers, is a good basis for efficiency of operation

Note The officer in developing areas, checking this chapter, could also refer to Appendix 4 for further information Adjustments of local currency against the Aust $ would be made, using local egg and feed prices and the graphs and tables would then be used in the same manner The number of birds needed for a unit would then be decided on living basis required in the area, after assessing the likely margin per layer (For companion also, 12 eggs make one dozen, and 2 2 lb equal 1 kilo)

CHAPTER 4

PLANNING THE POULTRY-FARM

THIS chapter is divided into two parts the first concerns planning the side-line unit and the second planning for the commercial poultry farm Before beginning the discussion I propose to offer some hints for newcomers to Australia who wish to engage in poultry-keeping here, either on a sideline unit or by running a commercial poultry-farm as a full-time venture The advice given here is intended to help you realize something of what is involved if you wish to engage in poultry-farming in Australia

1 Approach the district council or other body controlling the area where you live or wish to live, asking for information about the type of poultry sheds allowed, and the required distance of the sheds from fences and from the house Inquire whether plans should be submitted Consult the authorities on any other matters such as these—you should find them co operative, and they will help you to avoid getting into difficulties when you start If you do not make these inquiries first you are certain to break one or more of the regulations

2 If you wish to establish a poultry unit containing more than the number of birds allowed to be uncontrolled by your State's marketing authorities, the State regulations will compel you to sell the eggs as directed by the State Marketing Board unless you have a licence to sell them yourself to storekeepers or to other people who would like to buy direct from you Apply to your State Board for this licence or permit The Marketing Boards have been established to help you make a profitable venture of poultry-keeping and also to safeguard the quality of the eggs bought in Australia and overseas The regulations are designed to ensure that eggs are marketed in such a way that you will obtain the best price for them over the whole year

3 Whether you have kept poultry in your own country or not, it is necessary to realize that conditions differ from one country to another You should become acquainted with the methods that have been proved successful here, or you may have heavy losses of chickens and poor egg production A careful study of the methods set out in this book will acquaint you with proven Australian practices

4 You must realize that capital is needed to set about poultry farming, and you should work out your requirements carefully The costs given in this book can be taken as a general basis For example, if you wish to buy and raise 200 pullets it will cost you over $200, with day old pullets at 30c each and feed 2c per pound A shed must be provided for rearing the chickens, and there must be sufficient space to house the layers For a commercial farm other buildings, such as a feed-room, will be needed Using ordinary local materials, costs could amount to approximately

$400 for every 200 laying birds—and more if you buy ready-built sheds or have them erected With substitute materials, costs would be reduced

If you have only limited capital it is wise to begin in a moderate way and serve your training period with poultry as a sideline before attempting to start a large plant, but if you can afford to begin with a commercial farm keep closely to the methods described in this book with special reference to Chapter 1 Information on all aspects of poultry keeping—how to look after your stock, make the sheds, feed the birds correctly—is given here, and for particular problems the State Department of Agriculture should be consulted

THE SIDELINE UNIT

Sideline poultry-farming is the way in which many people begin in the poultry industry, and most of the eggs produced in Australia come from small farms of this type The following are some of the reasons why a person may wish to start a sideline or part-time unit

1 Limited capital the prospective farmer is not able to obtain enough finance to set up a full time poultry farm but has enough to operate a small-scale farm

2 A liking for or adaptability to poultry-farming this is rather a difficult question for some to decide, because until they have had some experience of the life they may not know whether they will like it or become adapted to it In many cases the serving of an apprenticeship on a sideline unit, without resigning from his usual occupation, will make it possible for a man to decide whether he wishes to take up poultry keeping

3 A need for additional income apart from that received from the ordinary occupation in this case the part-time poultry-keeper would have to carry out essential routine work morning and night, and the balance of the work at the week-end This type of unit usually demands a large measure of co operation from the farmer's family, particularly in the collection and packing of eggs, and therefore it would be an advantage if they also took a keen interest in the project

4 The need for an additional source of revenue on a small mixed farm where there is not much spare land available poultry-keeping is ideal in a case such as this, and would make the whole farm a more efficient unit If the poultry side of it is properly planned, sufficient time to work it can usually be spared from other farm operations

Size of Unit

The size of the unit is of vital importance If very small—say, 50 to 100 birds—it will really not be worth handling except as a hobby The reason for this is the labour needed some of the jobs on a poultry-farm take about the same time whether there are 100 or 300 birds This point is best illustrated by a few examples

1 When mixing the morning wet mash, or when filling a dry feed hopper with prepared feed, you can handle two buckets almost as quickly as one

2 Since the water-supply is automatic—or should be—no extra work is called for if there is a larger number of birds

3 The work of egg collection is not increased in proportion to the number of birds for one bucket would be sufficient to hold the eggs for *each* of the daily collections from 300 birds at any period

4 With deep litter practice, cleaning out is only an annual job, which can be done during one week end

5 Handling the replacement pullets as one batch of 150 to 200 does not take much more work or time than with one batch of 50 chickens

It can be seen, then, that the unit should be large enough to be economically worth while Look at it from the profit angle if an annual margin of, say, $1 50 per bird is made, 100 birds (50 pullets and 50 hens) returning $3 per week profit would be uneconomical compared with 300 birds (150 pullets and 150 hens) returning a profit of $9 per week This figure could be increased—by means of a higher pullet percentage—to between $11 and $12 per week My advice, therefore, is either to handle sufficient for household or hobby purposes only, or to have a larger unit that will give a worthwhile financial return

Time Required to Work Unit

The prospective sideline operator must also consider the amount of time needed to run the unit A free range farm with sheds widely distributed, although economical of investment, means that there will be greater distances to travel On the other hand, an intensive unit or laying-cage set-up would mean saving of time, but increased capital outlay The routine work necessary for a 300 bird unit—feeding, cutting greenfeed, and collecting and grading eggs—could be handled in two hours or less daily With free choice feeding, and lucerne meal plus vitamin A substitute for the greenfeed, this time could be reduced by one-third to one-half More birds could be carried because of the saving of time Cleaning, repairs, and checking of sheds are additional duties that can be carried out on a mixed farm at a time of day that suits the farmer, or at the week-end if the operator has a job away during the day and is only running the poultry after working hours Approximately 300 birds should be regarded as the average number of stock for the man who does an ordinary job of work—unless the equipment is designed for the minimum of labour requirements, with free choice feeding and either complete open range with one large roosting shed or deep-litter pens plus automatic water, or unless there is ready co operation from the family, including the children (in this case, double or treble the number of birds could be handled) It might be worked out on paper that more than 300 birds could be easily handled—so much time for this operation, so much time for that, and so on—but observation of many and varying units has shown that the human element must be considered there are times of extremely hot or cold weather, sickness, physical or mental tiredness, a need for recreation—all these must be provided for when another job during the day has to be done Otherwise the work for the poultry will be neglected, the plant will become inefficient, and the farm will fail

On a mixed farm, stock numbering 500 to 1000 birds can be considered—depending on whether the sideline unit is to be small or large A profit of

sufficient level, from a 500 bird unit, to pay most of the wage of a full time employee—to give adequate margin for investment and oversight—even though only portion of his working time would be directly on the poultry, is needed to warrant a unit An alternative could be to run the birds for part-year operation only—outside of the busy harvest periods (see also p 413) With a larger unit of about 1000 birds a greater proportion of time would be taken up at most periods of the year—unless the part-year programme is used In this case laying sheds only need be erected—they can serve for rearing also These various types of sideline units have been successfully operated on a number of mixed farms, enabling a member of the family to be profitably employed Introducing poultry to a mixed farm also means an additional avenue of production, so that "all the eggs are not in one basket" In many parts of Australia farmers have had reason to be grateful for their poultry sidelines, particularly during lean years in low rainfall areas With poultry, costs do not vary greatly between what are known as "good districts" and "poor districts' The cost of grain, bran, pollard, and meatmeal does not usually vary greatly from one area to another within a State, and these are the commodities that have the greatest influence on cost of production

Some Suggested Sideline Units

Unit 1 A 350 bird Unit with Intensive Rearing of Young Stock and Intensive Housing of Layers

Figure 10 is a suggested lay out for a unit of 350 birds in which there is intensive rearing of young stock and intensive housing of laying birds The area measures 80 by 50 feet (if greenfeed is grown the area should be doubled—approximately one fifth of an acre being needed for both plant and greenfeed) The positions of nests, roosts, feeders, and water are

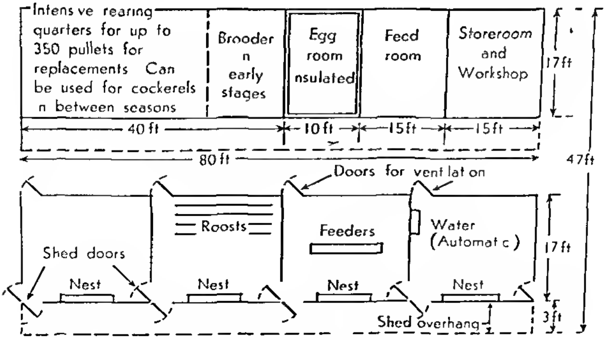


Fig 10 Suggested 350-bird sideline unit, with rearing of young stock and housing of layers under intensive conditions

indicated on one pen only. A unit of this type could be adapted for the laying-cage system, but it would increase investment costs. The rearing quarters could be used throughout the year to keep high-levels of pullets as replacements for battery-cages. (Cages are not advised if unit is in an urban area and problems with neighbours are possible.)

The cost of erecting Unit I could be reduced by using cheap substitute of material for the sheds—for example, sawn palings or rolled-out drums for the sides (see p. 42). The prices for materials will vary slightly in different localities, but adjustment allowing for this can easily be made. In an intensive unit such as this the birds can be conveniently handled with the minimum of labour, and working conditions are good in all weathers.

If the laying-cage system is adopted the cost might be increased by $2 to $4 per bird (depending on the type and price of cages—either two-bird or one-bird pen cages, with either single or treble tiers). The rearing portion of this type of unit can be used for raising grillers or cockerels during periods between the normal occupation of the rearing-shed by pullets. The deep litter used by the pullets can remain for the cockerels. In an area of this size approximately 400 grillers can be raised to ten or twelve weeks of age, or 200 cockerels to five or six months of age. Refer to Chapter 18.

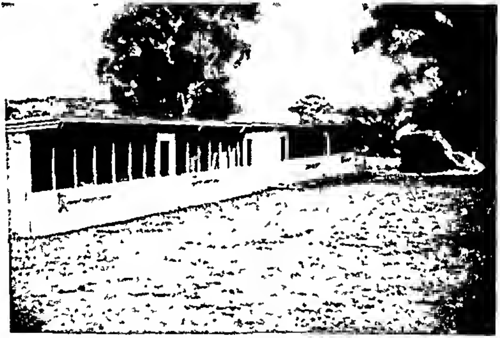


Fig. 11 A well-built, 400-bird intensive shed on a sideline unit, divided into 4 pens of approximately 100 birds each and measuring 20′ × 20′. Deep-litter practice, automatic feeding and watering are incorporated.

Unit II. A 300- to 350-bird Unit Combining Intensive Housing with Range Rearing

Where more land is available the intensive laying pen combined with outside rearing conditions is sound. Small pens are suggested as they have given a very high production figure per bird—in some trials there have been up to 30 eggs more than in large pens. When the cost of land is reasonable the investment cost will be considerably lower than with the

all-intensive unit The cost of erecting a shed for the layers does not vary greatly whether it is a large one for four pens of 80 to 85 birds or smaller ones to form 12-bird pens Approximate costs can be taken from the notes under Farm C (p 20) As with all units, use of cheap substitute materials for covering the sides of the sheds would reduce costs This unit has one laying-shed of the type described for Unit I (intensive), subdivided into four pens or twenty-five 12-bird pens of the type described in Chapter 12 At least two small outside rearing-sheds would be needed to raise the replacement stock, with an area of at least quarter of an acre suitably enclosed with a wire-netting fence and used each year for young stock only The quarter-acre is exclusive of the area needed for growing greenfeed

Unit III. A Free-range Unit Suitable for 300 *to* 350 *Birds*

On a farm where an area of about $2\frac{1}{2}$ to 3 acres is available for poultry, a unit that is very economical to install can be constructed The land can be rocky land that is not suitable for cultivation, or land with a steep slope Successful poultry units have been observed on these types of land as well as in dry, sandy areas, although here it is suggested that any natural scrub or trees be left standing, both from the point of view of shade for the birds and of preventing erosion This type of unit has also been used in orchards The stock can be housed in one large shed, an ordinary shed 20 by 20 feet would hold approximately 350 to 400 birds, because in a case where a run of 2 acres is available there would be need for roosting space for only this number of birds The area can be enclosed by 6-foot-high netting, and only one division need be made, which would also divide the shed Pullets can be put into one side and second-year birds into the other If the farmer wishes to avoid subdivision he can have Australorps one year and White Leghorns the next with all running together and the birds can be easily picked for culling after the second lay

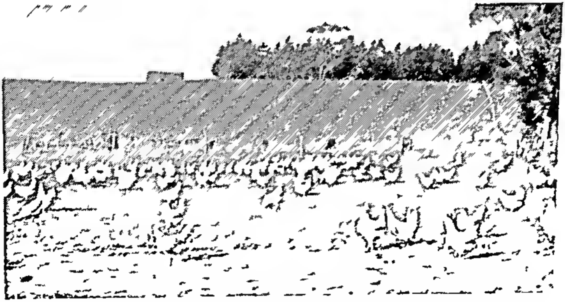


Fig 12 Crossbred birds on an open range sideline unit Crossbreds are well suited to this system, and satisfactory results can be obtained in well-drained areas with sufficient land available

Another method of identification, is the White Leghorn male x Australorp hen cross one year (white-legged pullets) and the Australorp male x White Leghorn hen cross the next year (black-legged pullets). The use of the all-pullet system is also recommended (see Chapter 7). It is possible for the birds to roam without a yard, but unless implement sheds are provided with doors, the farmhouse garden enclosed with wire-netting, and the dairy fenced off (or a long fence run across the property), the poultry will cause a good deal of trouble, and egg collection and general routine may be disorganized. The birds could roam freely in a location that is a long way from the other operations of the farm, but in this case the menace of foxes should be considered: they have been known to cause heartbreaking losses of pullets that were nearly reared. An enclosed area is strongly advised for a sideline unit.

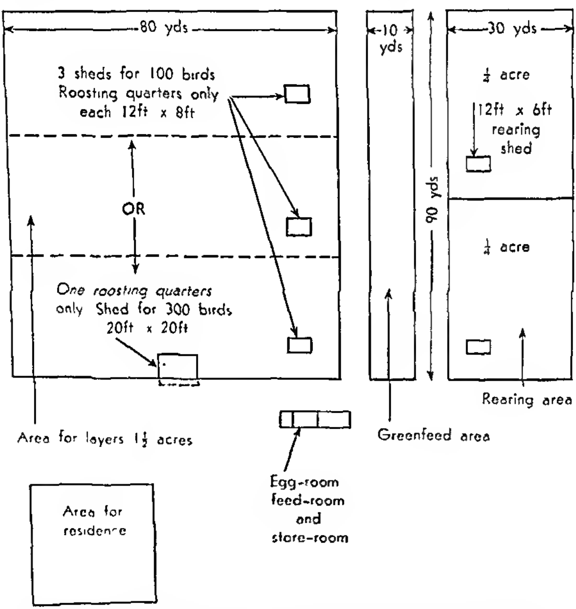


Fig. 13. Suggested unit for 300-350 birds on free range suitable where land is available at a low cost (or when running a unit in an orchard or on land not suited to other purposes). Allow 2½ to 3 acres under normal conditions.

Young stock would require the same separate area for rearing as in Unit II, and two rearing-sheds (or one combined shed) should be provided for 150 to 200 pullets to be reared each year. The area needed for this purpose is at least a quarter of an acre—half an acre if possible.

Smaller sheds might be considered instead of one subdivided shed; two sheds each 12 by 8 feet could be placed on one acre, or four sheds 8 by 6 feet. The sheds can be fixed or portable, and usually operate with a colony-type nest either in the front or at the back of each shed. Eggs can be kept reasonably clean in any of these free-range sheds by erecting a wire-netting approach to the nest—either a frame over the floor in the smaller shed or a wire-netting ramp (of one-inch mesh) set at an angle of approximately 45 degrees leading up to the entrance to the nests in the larger shed. The poultry are kept some distance from the house to prevent any possible troubles with smelly yards.

The cost of a free-range unit of this type is not very heavy, for only one square foot per bird (the minimum space possible) is provided, as compared with four square feet in an intensive unit. The cost basis is set out under Farm A (p. 19). When the birds are sold at the end of the

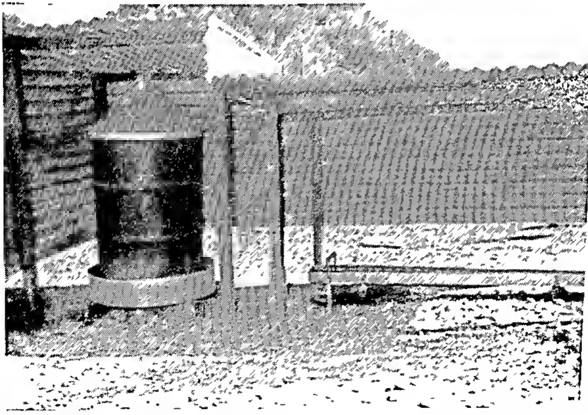


Fig. 14. Automatic feeder and waterer. A suitable feeder made with purchased tray and lid and a 44-gallon drum. The bottom of the drum is set on legs 2 inches from the tray floor. The tray is 6 inches high at the side and allows a 2-inch feeding space all round the drum. The feeder tray is set 4 inches above the ground (10 inches to the lip). This feeder gives sufficient feed space for 50-75 birds and need be filled only once weekly (or fortnightly, according to the number of birds) with dry mash. The automatic waterer seen in the figure saves labour. Both feed and water are under shelter to keep the water cool, save feed losses (from wind) and to protect birds from the sun when feeding.

laying stage a fair proportion—in some cases all—of the initial outlay on their purchase and rearing can be recovered, provided adult mortality is reasonably light This applies to all types of units

A poultry-farm like Unit III would give much better results than a farm where poultry are allowed to roam at large, since it allows for control of the birds and their ages Feeding and egg collection can be handled more efficiently, and with the poultry in their own quarters the farm will have a more pleasing appearance

Substitute Materials

In all these units the cost of housing can be reduced considerably by using substitute materials The sides of the sheds can be made of flattened-out oil or bitumen drums, or even of wheat-bags dressed with cement wash If the sheds are as specified, the type of materials used will not prevent a unit from being successful, provided the workmanship is good Many men have started with limited capital and been compelled to use cheap materials, and they have worked up prosperous poultry-farms It is very important that for the roof an effort should be made to have lasting and waterproof material The general constructional details of the sheds mentioned are discussed in Chapter 12

THE COMMERCIAL POULTRY-FARM

The planning of a commercial farm is a big undertaking for a person who has not worked in the poultry industry before Apart from the many technical and scientific requirements there is the question of capital If this is limited, second grade substitute materials may have to be used in the erection of the plant When it is being planned, certain basic principles should be kept in mind, and these apply to small units as well as to large ones

1 A ground plan of the farm must be prepared, in which there is a properly balanced lay-out for sheds It is depressing to see farms where sheds have been placed haphazardly, and furthermore casual arrangement gives extra work Sheds should be set out in a straight line, which makes them convenient for routine work such as feeding and egg collection To alter a farm once it has been built is, I need hardly say, a major task therefore, do your planning beforehand It does not cost any more to place sheds in a straight line, and it can increase the value of the farm, besides being more pleasing to the eye

2 Early in the planning stage draw up a planting programme for trees and shrubs These will not only improve the appearance of the property, but will serve a very useful purpose as windbreaks and as shade from the heat of the summer sun Almond trees or citrus trees or some other type of fruit-tree could be planted, as well as purely decorativetrees The State Department of Agriculture will give advice as to suitable species Most trees take a longtime to grow, so plant them early and you will enjoy them almost from the start If the greenfeed area is to be included in the unit, it must be provided for in the early stages of planning too It should be placed near the homestead for the sake of appearance and for convenience

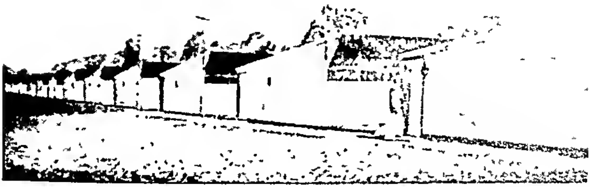


Fig. 15. An efficient, well-laid-out commercial farm at Alice Springs, Central Australia. Two hundred birds are housed per shed, 20′ x 40′, in 2 pens of 100 birds. Overhead wire is power line for electric lighting in winter, and spray line is used for throwing a mist of water in very hot weather. Automatic watering is installed.

The rearing quarters for young stock should be well separated from the adult stock quarters. This is highly desirable both for better control of disease and for improved growth of young stock during rearing. A fence alone is not sufficient—there should be a considerable area of vacant land between rearing-yards and adult-stock quarters. If the property has a slope build rearing-yards on the higher portion or arrange them so that drainage from adult pens does not flow into them.

CLIMATIC CONDITIONS

Local climatic conditions must be considered for the type of farm you wish to run. A certain system or a certain type of shed may be recommended, the poultry-farmer may spend a considerable amount on it, and then he may have disappointing results. This can be because the type of design chosen was not suited to local conditions It must be stressed that no one particular system or type of housing is suited to all districts. In cold climates, where temperatures often drop below zero—as in some parts of America and Europe—poultry must be housed in sheds with gable roofs, completely enclosed, with window ventilation and fans to ensure adequate changes of air and adequate insulation of walls and ceilings. These types of sheds are not suited to the Australian climate. Workers on experiment stations and commercial farmers have found that with high summer temperatures and mild winters such as we enjoy, semi- or fully open-fronted sheds together with sufficient opening at the rear of the sheds are usually suitable for high egg production. But variations are sometimes necessary in Australia, and on the plains, where the rainfall may not exceed 10 to 15 inches, poultry can be efficiently housed and will lay well in open-fronted sheds, in conditions bordering upon ordinary open-range housing.

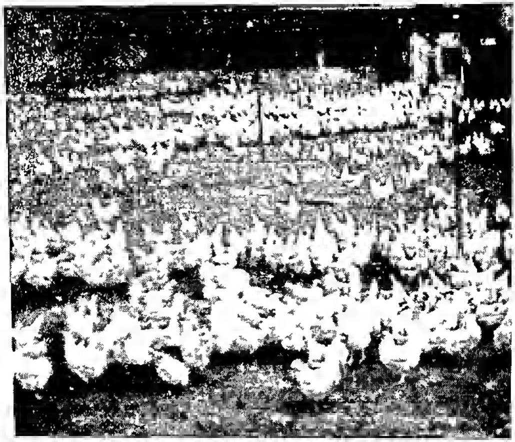


Fig. 16. An open-range farm with simple roosting quarters. Crossbreds are shown in an area with rainfall of under 10 inches. If correct feeding and handling are applied, efficient results can be obtained with a simple farm layout under these mild weather conditions.

Where temperature readings are near the century mark, a highly intensive or a battery-cage unit will operate well, but more attention will be necessary—e.g., cooling devices such as sprinklers, insulated roofs, sheds nearly open at rear, or slatted sides—to avoid the possibility of high mortality and maintain good lay.

Where rainfall exceeds 25 inches, and up to 50 inches or more in hilly areas, and the weather in winter is foggy and rainy, an intensive system is needed, such as large or small pens, involving good deep-litter practice, or possibly laying-cage units. The question of suitable breeds is discussed in Chapter 5.

In dry areas with mild winter temperatures, the winter production of eggs can equal the highest figures obtainable in other areas of Australia from small-pen units or laying-cages plus artificial lighting—and this without the use of any special husbandry practices.

It can be seen that very careful consideration should be given to the climatic conditions, and that it is necessary to have the type of unit that is suited to the local climate. Further reference to this matter will be found in Chapters 12 and 17.

SOME SUGGESTED COMMERCIAL UNITS

The plans and suggestions that follow can be used as a basis for various types of units: adjustments in size can be made to suit a particular area.

It cannot be said that these plans are the only suitable ones, eve cannot be said with certainty that one or other system of feeding ... followed: many poultrymen who are financially successful—and ... the principal yardstick—employ different housing methods, from free range to highly intensive, keep different breeds, use different feeding systems, and so on. Of course, some may adhere to a particular system because they have started with it, and would not find it easy to change or possibly a poultry-farmer may have a stubborn faith in a particular method. A failure to acquire up-to-date knowledge could be the reason why a farmer adheres to a less efficient system.

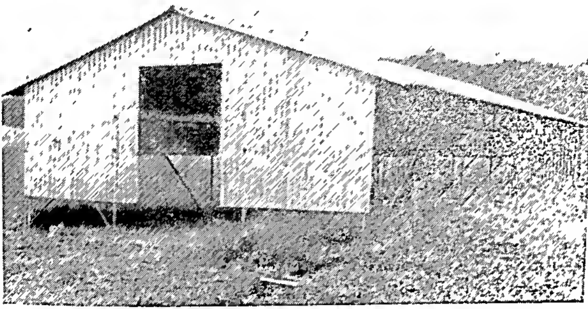


Fig. 17. Single-tier, small laying-cage unit of the Californian type. Very efficient results are obtained in suitable localities with a low-labour requirement. Some protection at the side of the shed (such as slats) is needed under wintry conditions.
—*(By courtesy of Multiplo Company.)*

Free-range Farm with Ample Land, Employing Minimum of Enclosed Shed Space (Farm A in Chapter 3)

This type of farm could be said to operate under controlled free-range conditions. Birds are often seen running loose on a general farm—some of the effects of this have been mentioned in the discussion of the sideline poultry-farm (p. 42). But, if unlimited range can be given to the birds—i.e. when no problems concerning nuisance to neighbours are involved, or when crops are not planted near by (poultry will roam nearly a quarter of a mile in search of pickings and greenfeed)—it is possible to plan an economical unit that will give satisfactory laying returns in a suitable climate. A large shed for roosting-quarters is needed, with three lines of netting fences (one separating the two ages of birds, the others run out to form a right angle on each side of the shed, which is divided into halves by the fence). A shed 80 by 17 feet could accommodate 1000 birds under

this system—each section of the shed, measuring 40 by 17 feet, holding 500 birds This shed should face north There would be sufficient room for the roosts and nests, and the shed would be most successful where unrestricted range was made available The climate is of primary importance with this type of unit sandy soil and an annual rainfall not exceeding 12 to 15 inches, indicating warm winter conditions, is ideal for the purpose In districts where drainage is good this unit has worked well with 25 to 30 inches of rainfall annually Young stock would need to be purchased in one or two lots, to avoid the setbacks that would occur if smaller lots were put together at the rearing stage Precautions will have to be taken against foxes, possibly by the use of dogs and by closing the doors of roosting quarters at night A unit of this type can prove economical of labour Satisfactory results will not be obtained with large numbers of birds if the area is restricted and there are roosting quarters only

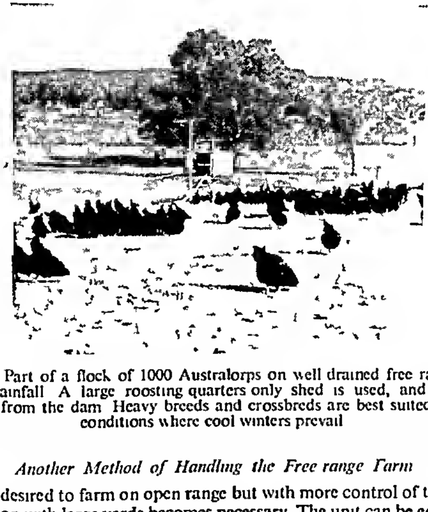


Fig 18 Part of a flock of 1000 Australorps on well drained free range with 25 inch rainfall A large roosting quarters only shed is used, and water is available from the dam Heavy breeds and crossbreds are best suited to these conditions where cool winters prevail

Another Method of Handling the Free range Farm

If it is desired to farm on open range but with more control of the birds, subdivision with large yards becomes necessary The unit can be composed of small 50 bird sheds each 8 by 6 feet, or 100-bird sheds consisting of two of the small sheds joined together to form one unit measuring 16 by 6 feet or 12 by 8 feet, as desired The best aspect for the sheds is a northerly one

If a number of sheds are to be run in one enclosure, the birds for each shed must be trained for a period with a temporary enclosure This is simplified if separate yards are used but these would be more expensive,

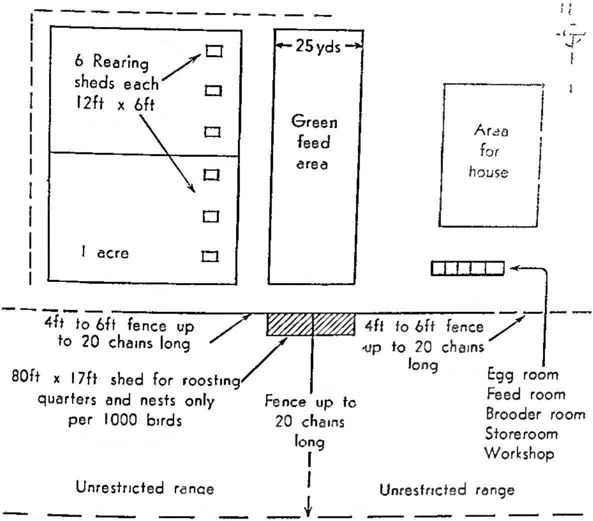


Fig. 19. A suggested free-range unit layout per 1000 with unrestricted range for the layers. Range used by layers may be up to 30-40 acres, combined with other livestock using the same area.

on account of the extra fencing that would be needed. Provided feeding of mash and grain is carried out at each shed (or a hopper provided), and water is close by, it will be satisfactory to have a number of sheds in one enclosure, but the poultry will tend to drift towards the end from which the mash and grain are brought, if daily feeding adopted, unless they are properly trained. This might cause overcrowding in some of the sheds, with adverse effects on health and production. The area needed is one acre for 200 birds—this should be regarded as a *minimum.*

Details of free-range houses are given in Chapter 12. Tests on experiment stations and observations on poultry plants have shown that satisfactory laying results can be obtained with this type of unit. Rotation of yards is strongly advisable, requiring one and a half to two acres of extra land, so as to spell each block every three or four years.

Semi-intensive Farm: Laying-sheds are Semi-intensive and Rearing Quarters are Free Range (Farm B in Chapter 3)

A unit with semi-intensive laying-sheds and free-range rearing for the young stock is more costly than the free-range unit discussed in Chapter 2, but the work of handling the birds is considerably reduced, clean eggs are

more easily obtained, and the routine work is much more pleasant in cold weather, for most of it is done under cover. Buildings such as feed-sheds and laying-sheds should be located as near as practicable to the residence, although not too close. This type of unit is satisfactory for deep-litter use where weather conditions are mild to moderate, but intensive laying-sheds are best where rainfall is considerable.

A practice adopted by many poultry-keepers when greenfeed is grown on the farm is to have the greenfeed area adjacent to the residence, and the

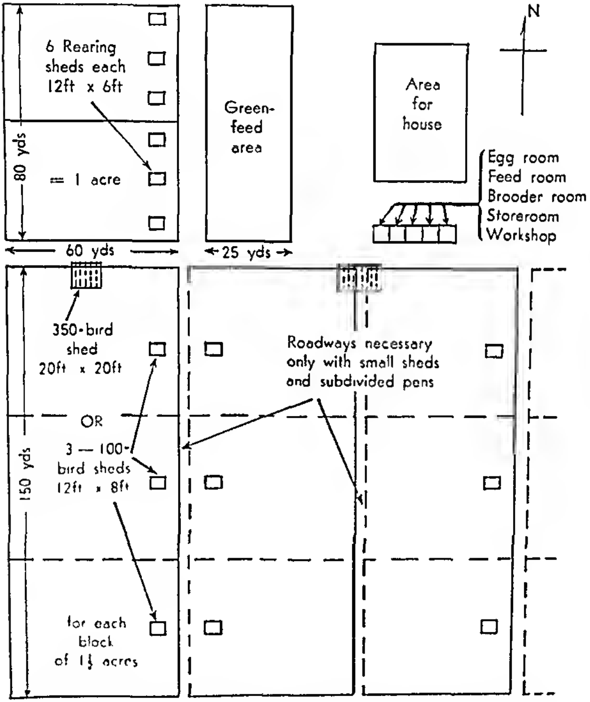


Fig. 20. Suggested free-range unit layout per 1000 birds with subdivision of area for layers into enclosures using 6 or 7 acres, but having 8 to 10 acres if possible for periodical rotating of laying stock areas.

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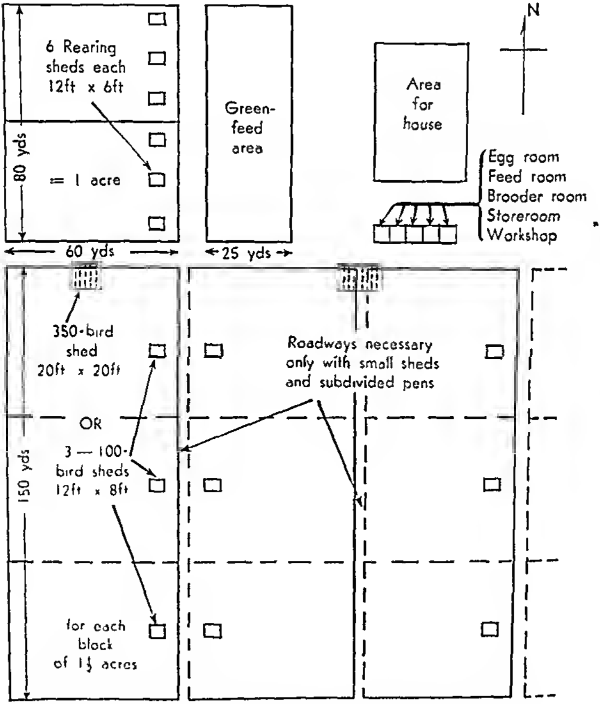


Fig. 20. Suggested free-range unit layout per 1000 birds with subdivision of area for layers into enclosures using 6 or 7 acres, but having 8 to 10 acres if possible for periodical rotating of laying stock areas.

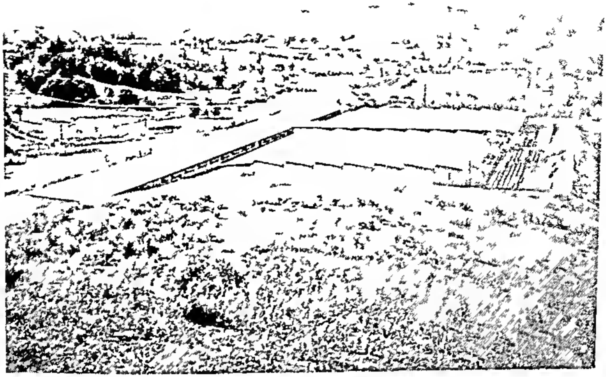


Fig 21 A large and well laid out sawtooth shed laying-cage plant in Queensland Capacity 20,000 layers —(*By courtesy of Poultry*)

sheds beyond This is to be commended both from the viewpoint of having pleasant surroundings for the home, and having the greenfeed convenient for cutting and watering The chicken rearing yards which under normal conditions should require attention for only six months of the year, are placed farther from the residence and feed shed than the laying-sheds, which should be close to the egg-room and feed shed This relationship of the laying sheds, egg-room, feed shed, and rearing quarters is important, for if the layout is haphazard many extra chains or even miles a day may have to be travelled, which is not only tiring but time consuming The brooder shed should be near the house, for although it is tended for a period of the year only, frequent visits have to be made to it when it is being used, including a check last thing at night (a necessity on all plants) Other buildings are as shown on plan Details of the various sheds are given in Chapter 12

Intensive Farm with Range Rearing of Stock (Farm C in Chapter 3)

Without significant variation in cost this type of farm can be used with pens of 85 to 100 birds or with pens of 12 to 14 birds The smaller pens are lower, can be erected with lighter material, and are easier to build Although more labour is sometimes required for handling pens of this type, production results are much better, 2 to 2½ dozen eggs more per bird having been recorded in the smaller pens as compared with large pens This question will be discussed in more detail later in this chapter The intensive laying farm with range rearing of stock is well suited to wet and hilly areas

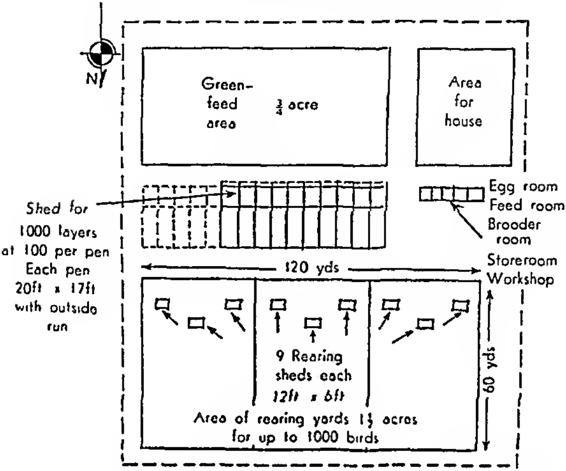


Fig. 22. Suggested semi-intensive farm layout with free-range rearing quarters. This unit would accommodate 1000 birds, and has sufficient area for expansion to 1500 or more. Area needed 3½ to 4 acres.

Fig. 23. White Leghorns in a well-built, 350-bird intensive (40' x 20') shed in South Australia. Intensive sheds of this type give warm winter conditions on deep litter, and are very efficient in relation to labour required for attention.

small area, which is an advantage when land is costly Houses of two, three, or more storeys could be erected, (as applies overseas where sub-zero temperatures call for shed-heating systems or solar-type houses), but of course this would mean very greatly increased costs, and there would need to be a lift or other special equipment to facilitate the care of the birds housed on the upper floors If a farm is so situated that only a very limited area is available for the poultry buildings, it may be necessary to have multi storeyed houses, but this is not recommended for Australian climatic conditions Further details are given in Chapter 12

Intensive Farm with Small pen Units

The cost of establishing an intensive farm with small-pen units is not higher than that for the large-pen farm Expense for the divisions can be kept down by using lighter construction timbers, by restricting the height of the divisions, and by netting for each two out of three From observations made on farms and in official tests it can be said that this type of unit has many advantages, and results in as good egg production per bird as single bird pens From good pullets 220 eggs and over hen-housed lay per bird per year can be expected Some of the advantages are

1 There is no overcrowding It is a recognized fact that whenever stock are congregated in large numbers in one group, the output per head is reduced, owing to the bullying and crowding that occurs, and in addition there is a greater risk of disease under these 'stress" conditions

2 The laying results are better in smaller groups—for example, in groups of ten birds daily collection of 9 and 10 eggs is not infrequent, whereas in pens of one hundred birds, 70 to 75 eggs per day is regarded as a very good maximum collection The winter production from pure breed pullets has averaged over 60 per cent for April to July, with over 70 per cent production in May under unlighted conditions with average cross-bred stock

3 In controlled experiments the overall production per pullet has been found to be up to 30 eggs more in small pen units than in large Tests carried out with ten-bird groups in South Australia in 1941-2, 1945 6, 1952-3, 1953-4, and 1954-5 gave an average production over all tests of just on 200 eggs per bird in twelve months, the trials covering over one thousand birds These tests were made with pure breds—White Leghorns and Australorps Figures for crossbreds have been shown to be much higher in small flocks, too, shown by laying results exceeding 260 average for 12 months in recent Victorian and South Australian Random Tests

4 It may be thought that the handling of these units will require a great amount of labour But a correctly planned unit of this type can be handled with labour comparable to that required for large pens This conclusion is based on observations of farms employing this type of unit, and on experimental work carried out with these units

The following equipment and methods have proved satisfactory.

(a) Automatic water is made available outside at the rear of the shed (or in passage with gable type shed) in a long gutter controlled by ball-valve or float operating according to the water level in the trough

(b) If wet mash were used the feeder is placed outside the shed, in front, so that the operator can put the mash into the feeder without entering the shed. A 6-foot feeder used on one side only is more than sufficient for ten to fourteen birds. The feeder can be a piece of D-guttering nailed in front of the shed just under a 3-inch gap which continues under the door (or it can be arranged to have a feeder that tips outward for filling with mash and then inwards to enable the birds to feed, or the feed can be dropped through a chute). Between 1000 and 1200 birds can be fed in this way in a very short time. The gap is set at 15 inches above floor-level (not litter-level).

With the dry-mash or all-mash system a hopper can be placed against the front of the shed and filled weekly from outside the pen Alternatively a double sided hopper can be placed between two pens or a hanging feeder used. Arrangements such as these will reduce feeding attention to a minimum—once-weekly operation from a feed-cart outside will suffice

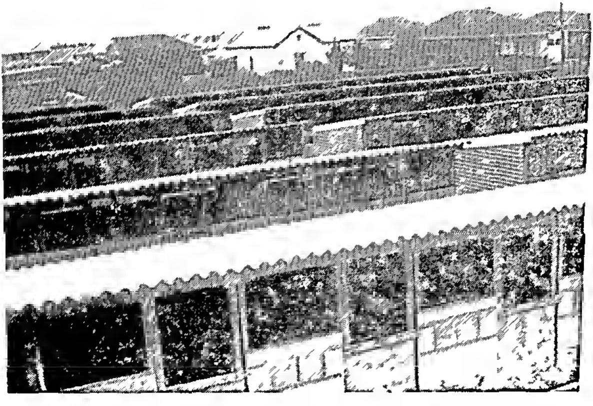


Fig 25 Farm with 8 x 6′ intensive pens holding 12-14 birds These units are well ventilated, watering and feeding is automatic, and deep litter is used Dry-feed hoppers need only be filled weekly Colony nests are set just inside the front, and eggs are collected from outside the pen through the slides shown

(c) The nests can be placed along the front of the pens about 2 to 2½ feet from the ground (this will make the collection of eggs easy) Entry to the nest is through a hole cut in the front of the shed, corresponding to the open front of the nest Though this will enable the eggs to be collected very easily, it must be realized that some of them may be laid on the ground, and therefore you will have to enter the pen on occasions A suitable nest material such as shavings will reduce this trouble to a minimum A

sufficient overhang in front of the pen will protect the nests from the summer sun. Alternatively, the nests can be set inside the front and the eggs collected through a slide.

(d) The incidence of disease is very considerably reduced in these pens and, should an outbreak occur, it will spread slowly, and is more easily dealt with than in a large pen. Also there is less need for a high level of husbandry skill than with flocks in large pens. Further details are given in Chapter 12

Range-rearing Quarters

The rearing-quarters common to Farms A, B, and C consist of a fenced area of at least one acre for 750 to 800 young stock, with either 50- or 100-bird sheds—i.e. sheds measuring 8 by 6 feet or 12 by 8 feet. The rearing-quarters should be quite apart from the adult houses and yards. Complete details are given in Chapter 12.

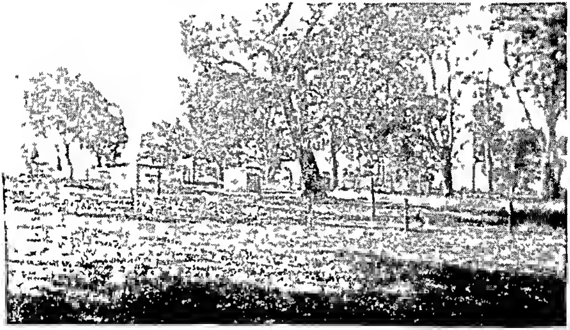


Fig. 26. Range-rearing sheds with ample room under ideal conditions. Land is well drained, has good pasture and shade. Here over 1 acre is allowed for 600 young stock. The site is isolated from adult birds, and drainage is from unoccupied land.

All-intensive Farm: With All-intensive Rearing of the Young Stock, and Layers Housed with the Deep-litter System (Farm D in Chapter 3)

The general notes for Farm C laying-quarters, employing either the large shed or the smaller units, apply to the laying-quarter requirements for Farm D, without any variation. The variation in the plan concerns the rearing-quarters. A shed on the same lines as a large intensive shed has been one of the most successful for intensive rearing of young stock, although some poultry-farmers have had very good results with rearing in individual pens.

The number of chickens that can be raised in a shed is usually double

the adult-hen capacity of a shed. This allows young stock to be brought up to half-grown stage, when the most forward are moved to their permanent laying-quarters, the allowance of two square feet per pullet being quite sufficient up to this stage. The practice of deep-litter control in the shed is a necessity with this system. In the large shed it is customary to use the roosting section for brooding for the first month, the chickens being allowed the full run of the shed gradually after one or two weeks—according to weather conditions and the growth of the chickens. The colony-type kerosene brooder or the infra-red brooder is suited to this type of rearing unit. With all-intensive rearing there will be no need to move young stock during the growing period if given sufficient room.

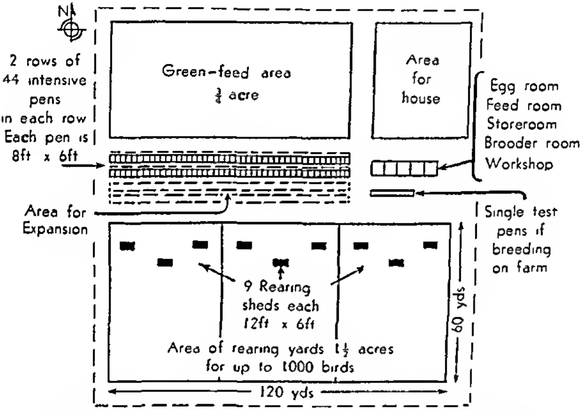


Fig. 27. Suggested intensive farm layout using small-unit, intensive laying pens and range-rearing quarters. The unit shown would accommodate 1000 birds, but could take 1500 or more. Area is approximately 3 acres, but this could be reduced to 1½ if intensive rearing quarters were used

This can considerably reduce labour on a unit. Also the intensive rearing space can be used for layers for a period of the year (see also pp. 205-8). On some farms there has been an endeavour to strike a compromise between the two systems for rearing the young stock, but it does not give good results and the stock will not make the growth of which they are capable. Intensive rearing under cover works satisfactorily when combined with efficient control of deep litter and correct feeding. Free-range rearing gives excellent results and is more economical in regard to feed.

The use of a small area of land with a shed for roosting-quarters will give poor results: a small area not under cover will soon become a bare,

overstocked yard with consequent unthriftiness in young birds. Employ either intensive rearing or open-range rearing, but do not try to compromise by combining features from each system. For growth and economy range rearing is preferred, if possible, for pullets, but with good husbandry and correct feeding, excellent results are being obtained under intensive conditions, and this is normal practice on most present-day units.

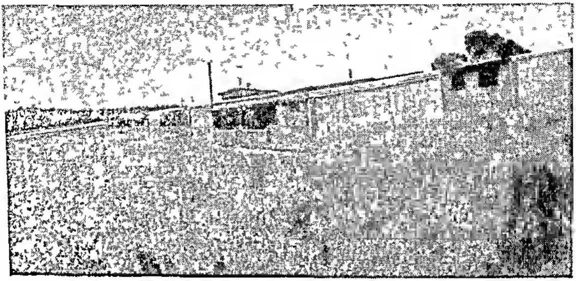


Fig. 28. A South Australian farm with intensive rearing sheds and laying-quarters for 3500 birds. Situated in the hills, it has a heavy rainfall (50 inches) and cold winter. Sheds are 80′ x 17′, housing 400 birds in each. The pullets are reared in groups of 800 in sheds of this size until half grown, when numbers are reduced until near-laying stage.

Intensive-rearing quarters increase the capital cost of the unit, but make it possible to handle the farm on a very limited area of land, as shown in Fig. 29. This type of rearing unit can also be worked in conjunction with a battery-cage unit.

Although the work of handling is reduced considerably for intensive rearing, it is necessary to see that the chickens do not want for any essential constituents in their diet or surroundings, or they will easily acquire vices. Good sanitation can be provided, but do not rely only on this while ignoring such practices as deworming and fowl-pox vaccination. Birds can become worm-infested in sheds of this type even though an impervious floor is used, and intensive conditions are no safeguard against fowl-pox and kindred complaints.

Greenfeed in wet or dry form should be provided in the intensive system, both for its health-giving properties and because of the consequent reduction in feeding costs. (Pullets have been raised intensively on relatively plain rations mixed with skim milk, and ample quantities of chaffed lucerne were available to them; their appearance, their growth, and the deep pigment of their legs and beaks were all that could be desired.) If "wet" or "fresh" greenfeed is not available, lucerne meal plus vitamin A substitute must be given.

When chickens are being raised in the laying-shed, or all the sheds are

used in turn as rearing- and laying-sheds, the deep-litter material can begin with chickens, and if it is correctly managed it can remain for the lifetime of each flock of birds. This system considerably reduces labour in the raising of replacement stock. When the rearing-shed is used for pullets only, meat birds can be raised successfully on the same litter during the six months when the shed is not occupied This fits in quite well with correct rearing-times, for pullets hatched up to September would be out of the shed by March This would enable meat birds to be put through and reared ready for market by August (provided marketing conditions were satisfactory). Information on raising meat birds is given in Chapter 18.

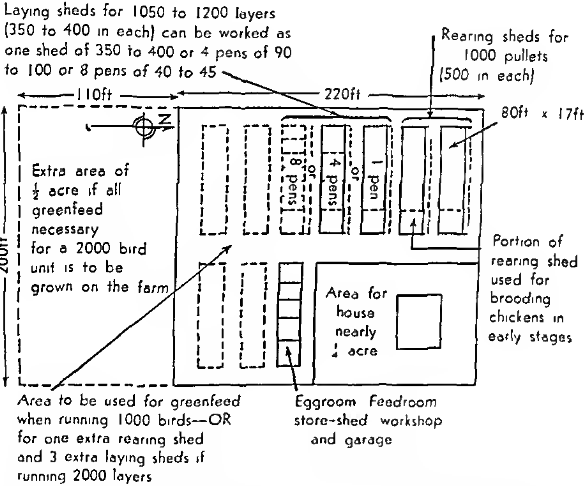


Fig. 29. Suggested intensive farm layout with intensive quarters for rearing young stock. The laying-sheds on this unit are in groups of 350, or 85 or 42 birds *per pen according to* the *subdivision* adopted The farm shown would accommodate 1050 birds, and sufficient area is available for expansion to 2000 The total area is approximately 1½ acre

Farm Using Laying-cages

The use of laying cages in Australia has increased considerably over the last four years and is popular in America and in England With birds in single pens, high laying figures have been obtained with suitable breeds and rations Single pens are an advantage either in battery-cage units or as single-pen deep-litter units, but the latter are very costly Winter production is very good under lights in batteries Approximately 2½ square

feet per bird, including passageways (even more with some types) must be allowed in the shed or under cover The area in the laying-cage should be 1¼ to 1½ square feet per bird. With single-tier laying-cages much expense is saved on the sides of the sheds

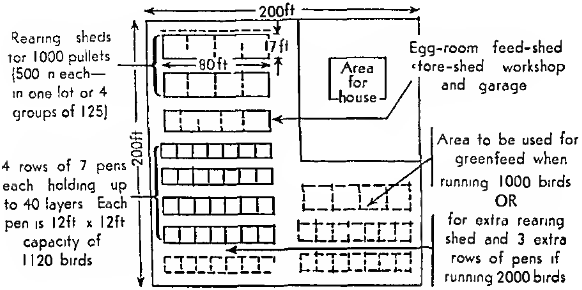


Fig 30 Suggested intensive farm layout with intensive quarters for rearing young stock This unit has laying pens to hold 40 birds in each The farm shown would accommodate 1100 birds and could be expanded to nearly 2000 The area is approximately ¾ acre, ¼ acre more should be allowed, if greenfeed is to be grown on the unit for 2000 birds (Sheds face north)

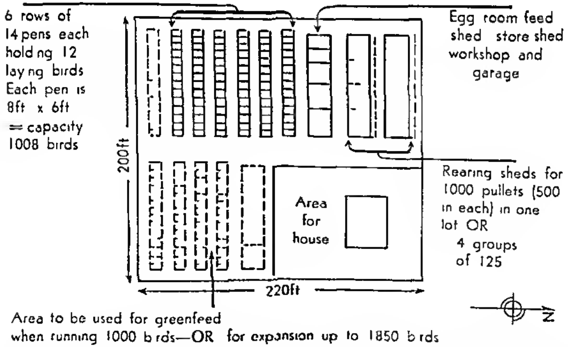


Fig 31. Suggested intensive farm layout with intensive quarters for rearing young stock This unit incorporates small laying pens of 12 birds each For 1000 birds the area is approximately ½ acre, but expansion up to 1850 birds is possible with the ¾ acre shown, or the extra ¼ acre is available for greenfeed

The costs for laying-cages may range (for single bird cages) from approximately S1 to S4 per bird, which could mean approximately S1000 to S4000 per 1000 birds, and this must be assessed for the laying portion of a unit when a decision is being made either for batteries or for intensive floor-housed stock. Figures given in Chapter 3 for intensive Farm D can be used as a basis in assessing costs. Another factor to be considered is that consumption of feed may be heavier than with birds on the floor even when high-energy rations are used. Eggshell quality can be a problem in battery laying-cages, but if the birds receive suitable hard grit, and the diet is adequate, the shell-texture of eggs laid by cage layers, particularly pullets, is quite good.

The birds can be culled easily in single cages for performance and, provided spare birds or replacement stock are produced or purchased on a regular basis the batteries can be kept full. The health of the birds in the single pens is very good, and control of disease is much easier. Laying-cages offer a suitable method of testing pullets singly from full- and half-sister families where individual performance as well as group performance is desired. The tiered laying-cage system is admirably suited to the requirements of a research station such as the C.S.I.R.O. Poultry Centre, but

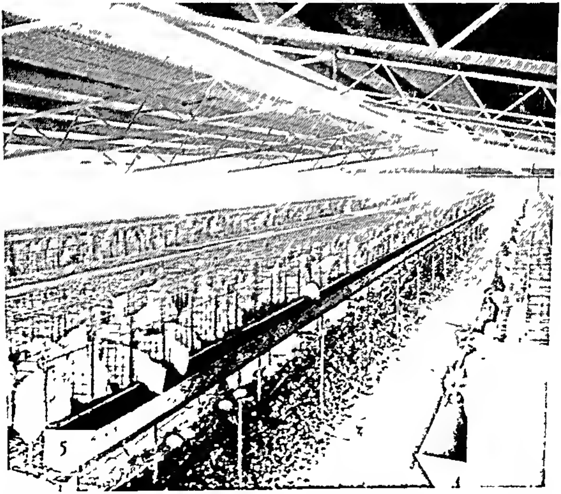


Fig. 32. View of laying cages in sawtooth roof shed plant. Tubular steel is used in the shed construction. Lights for use in winter as an aid to a higher rate of lay can be seen. Single and double bird cages are used.

(By courtesy of P S H)

F N Milne, Senior Husbandry Officer (Poultry), Department of Animal Industry, Queensland, pointed out that a cost of over $6000 per 1000 birds for shed and cages of this type would be a very heavy investment for a commercial farm He said that the mechanical clearing of droppings by means of a belt did not work well, for the present type of belting at that time had only a short life A scraper system was later used at the Poultry Centre at Werribee for multiple-tier battery-cages.

In his book *Laying Batteries in Australia*, J. G Hardy also pointed out that the cleaning-belt was not practicable. He used individual dropping-trays which are cleaned out daily. His book gave interesting and practical

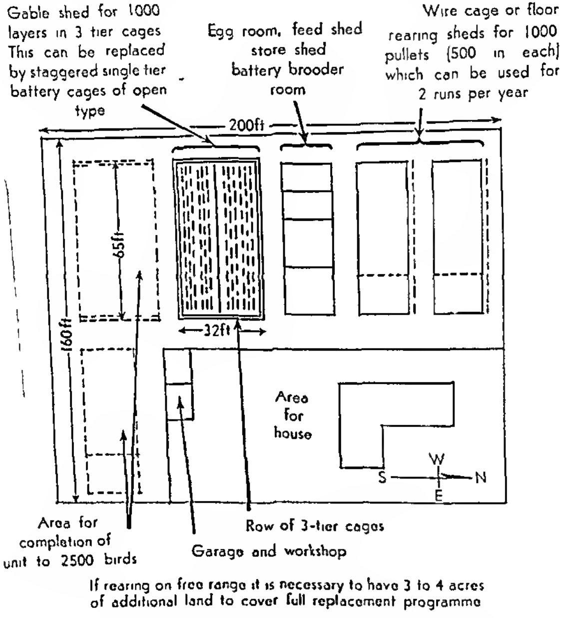


Fig 33. Suggested layout for a laying cage system farm using intensive rearing methods, allowing up to 100 per cent replacement The space of ¾ acre would allow for 2500 layers, and the establishment of a commercial poultry unit on a small area. The type of cages could be tiered or staggered, but under present-day experience the sawtooth shed with single level system, as in *Fig. 32*, is most popular.

information on the routine procedure and problems involved in handling layers in multiple-tier cages

Cage operations in New South Wales have been described by S. J Wilkins, former Livestock Officer (Poultry) Use of the laying-cage system promotes high egg-laying performance, particularly with crossbreds, but factors such as egg shells that are below par in some cases, high installation costs of the unit, heavy depreciation costs involved with cages, and feed consumption must be considered at the same time Flies must be controlled by cleaning, spraying, and use of electric fly-killer wires (with high voltage and low wattage) Single-pen units are the most suitable for the laying cage system, for they prevent crowding and cannibalism, and enable culling to be accurately carried out Large units are a better economic proposition, for they would warrant high capital costs for equipment and possibly mechanized operations Battery-cages range in type from open-air single-tier ones (the most popular and economical type, with one or two birds per cage) to batteries of fixed or rotating type and three or more tiers Further information on laying-cages is given in Chapter 12

Detailed information on the handling of laying-cages in the United States, with particular reference to California (where there are climatic conditions similar to those in some parts of Australia), is given in *Keeping Chickens in Cages,* by Roland C Hartmann and Dale F King

SUMMARY

1 A poultry unit must be large enough to be worth running, whether as a sideline or as a commercial farm Many operations take nearly the same time irrespective of the number of birds handled Plans for varied types of units, both sideline and full time, have been given

2 Success of the unit will depend upon adoption of the right system for a particular area, to be decided by climate, area of land, and facilities available The intensive unit is the most efficient for labour

3 The lay-out of a unit must be planned with the idea of saving labour on routine tasks Labour requirement is the greatest single factor in determining the number of stock to be handled Assessment should be made of the work entailed for all operations at various seasons of the year A free range unit can pay on a general farm

4 With limited capital it is better to start in a small way and build up from a sideline unit than to start with a full-size farm

5 The number of birds per pen and the influence of properly planned small pens on the rate of lay should be considered The efficiency of the cage-laying system in suitable areas should be assessed

6 It is worth incurring higher capital investment if output of eggs per layer is materially increased, with consequent savings in feed costs per dozen eggs produced, as this is the major annual cost

CHAPTER 5

CHOICE OF STOCK FOR COMMERCIAL POULTRY-FARMING

WHAT is the best breed? This question has been asked by many, and the answer can depend upon the requirements or preference of the person concerned, and also upon the locality in which the farm is being set up

In Australia there are only a few breeds that will give sufficiently high production to warrant selection for commercial egg production The capabilities and characteristics of these breeds will be described as a guide to selection for egg production only or for a combination of purposes

White Leghorns are the most popular pure breed in Australia In recent years Australorps have been improved, and in suitable localities they have given laying performances as good as—and, in some instances, better than—White Leghorns Rhode Island Reds and Langshans have also given good laying performances under suitable conditions But it is not the breed alone that counts the strain or line of stock is the most important factor, and the value of a strain is determined by its average performance and breeding background Crossbreds are now very popular, being kept on nearly all commercial units This is because of the marked lift in production—from 20 to 40 eggs increase—with the progeny when suitable lines of White Leghorns and Australorps are crossed

H G Belschner, the former Chief of the Division of Animal Industry in the New South Wales Department of Agriculture, pointed out that in early New South Wales random tests strains of poultry in Australia were shown to be not far behind oversea countries in high production and low mortality rate An average annual production of over 16 dozen eggs with less than 10 per cent mortality has been demonstrated in the tests, which is comparable with other countries

In the 1956-8 Random Sample Test the top pen laid a hen housed average of 250 33 eggs per bird for the 36 pullets in the entry at 24 weeks of age This lay was for a period of approximately 14$\frac{1}{2}$ months from first egg laid—the average for this group was just over 200 eggs for 50-week period—1st April to mid March In South Australian Random Sample Test 1960-1 crossbreds averaged 243 equivalent yearly rate of lay

In the 1964 5 Victorian Random Sample Test the top group of 60 crossbred pullets laid 304 average in the 595-day test from day-old stage, on hen housed basis These results show the effect of improved breeding techniques used over the last 6 to 7 years in Australia

WHITE LEGHORNS

The finest of our White Leghorn flocks compare very well with Leghorns in other countries They are best suited to hot, dry areas, but will also lay

well in wet districts if suitably housed—in intensive sheds, for example. They are practically free from broodiness, and are more successfully handled under intensive conditions than other breeds. They lay white-shelled eggs. These birds have been kept on many of the poultry-farms of Australia, for their breeding or genetic background for egg production is first-class, and tests with various systems of housing and feeding have consistently proved them superior to other light breeds. When Leghorns are housed in single-type intensive pens, such as those used for egg-laying competitions, a high rate of lay will be obtained. An average of 217 eggs per bird in twelve months was obtained for all White Leghorn entries (135 in all) in the 1953-4 official competition in South Australia. Tests of White Leghorn pullets housed in units of ten or twelve birds have shown that production figures can average well over 200 eggs per bird. In a large pen of one hundred or more birds at least 180 eggs should be obtained. This figure has been exceeded in some cases with well-bred stock and good husbandry. Flocks of 400 or more White Leghorn pullets in a pen have also given high production figures when husbandry has been of a high standard. White Leghorns can be intensively housed with less space than heavy breeds: 3 to 4 square feet per bird will suffice, depending on local conditions—4 feet being preferable for a high-rainfall area.

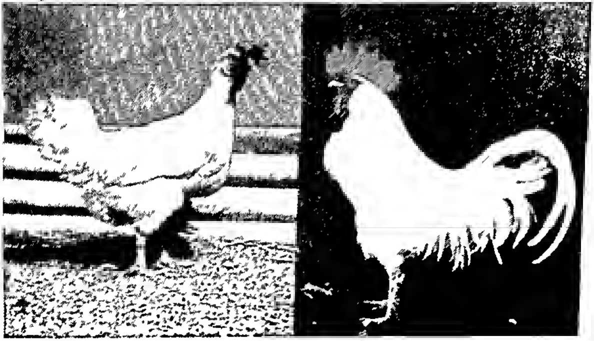


Fig. 34. The Australian White Leghorn, well known for high-level performance, has established many egg-laying records. It is the outstanding light breed in any country, being the basis of the best crossbreds for eggs or meat. The hen laid 284 first-grade eggs in its first season, and the male is of standard type. —*(By courtesy of "Poultry" and F. M.)*

The carcass value of White Leghorns is not as high as for Australorps or crossbreds when it comes to disposal at the end of their laying period of one or two years, but the value of the extra eggs produced often compensates for this. Cleaning of white-shelled eggs is more exacting than with

darker-shelled ones, and the White Leghorn shell is not quite as thick as that of the heavier breeds (The cleanliness of the shell, however, depends to some extent on correct feeding and also on the type of housing employed.) White Leghorns are also prone to neck-moulting when hatched early or when subjected to any marked change in conditions, such as altered feeding or routine. Cockerels are not a good proposition for general table purposes, but have been handled on a payable basis when marketed early, that is at seven to eight weeks. Leghorns are the basis for the best egg-laying cross—with Australorps. They also introduce the quick-growth factor that is a characteristic of White Leghorn young stock. Leghorns normally start laying at six months of age, although early-hatched stock will often start at five months or just over. As a general rule they will lay at least two or three weeks earlier than heavy breeds. No major difficulties are experienced in feather colour. They are often nervous birds when in pens, and anyone handling them should always enter the pens quietly, and should dress and act quietly also, and see that there are no unusual noises if possible.

OTHER LIGHT BREEDS

The other light, or Mediterranean breeds, such as Anconas, Black Leghorns, Brown Leghorns, and Minoreas, do not approach the laying figures of the White Leghorn and are not extensively bred nowadays, for they do not possess other advantages to counterbalance the lower egg production.

AUSTRALORPS

Australorps have become increasingly popular in recent years, and the shortage of well bred stock is being overcome. Great credit is due to Australian breeders for evolving the Australorp—the Australian Utility Black Orpington. The standard submitted by the National Utility Poultry Breeders Association of Australia indicates what is to be looked for as a background to the breed. Egg-laying trials and commercial experience have established the breed as a close rival in egg production to the White Leghorn, particularly on sideline units and in the cooler and wetter districts of the various States. Averages of 200 eggs per pullet have been obtained. In the 1957-8 official South Australian test the Australorps averaged 220 eggs. The Australorps' greatest asset today lies in crossing with White Leghorns.

Winter egg production of these birds tends to be higher than that of White Leghorns, and tests have indicated that Australorps, given adequate free-range conditions and with correct feed practices, will equal the production of White Leghorns under artificially lighted conditions in medium to large flocks. Australorps do well on open range and under farm conditions, but can also be successfully handled under intensive conditions. Cleaning their eggs is not difficult, for they do not tend to stain the eggs when laying, as often occurs with White Leghorns, nor does the brown shell show stains as the white does. Australorp eggs, having a thicker shell, travel better. Changes in the weather and slight upsets do not affect this breed as much as the White Leghorn. They may become broody easily but breeding work can reduce this. They have performed

well under hot conditions, as in Queensland They may lay as soon as White Leghorns they usually start laying at 5½ to 7 months according to whether they were hatched early (5½ to 6 months to lay) or late (approximately 6 to 7 months to lay) in the season Cases have occurred of earlier laying by Australorps that have been given very good rearing conditions and correct feeding This breed is not as subject to colds when being penned from the range as White Leghorns are, and at the end of the laying period the carcass value is higher The cockerels are very suitable for table purposes, although the dark skin discourages buyers in some markets The chickens are not reared as quickly as White Leghorns, and there is a tendency to higher mortality Very well-lighted brooding conditions are necessary to bring them to their feed Their feather colouring does not present a problem

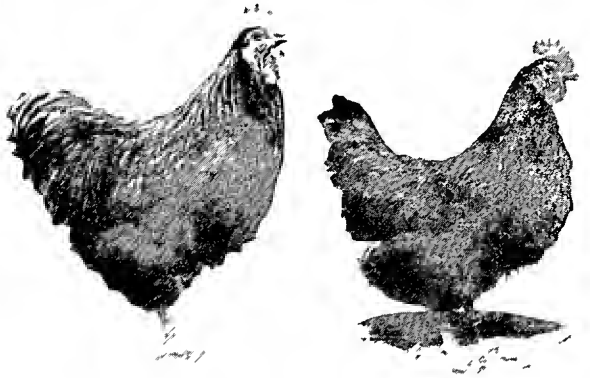


Fig 35 Bred in Australia for egg-laying, the Australorp has become a very popular breed It is hardy under varying temperature conditions, either intensively or on free range The hen laid 278 first grade eggs in its first season, and the male bird is of standard type

—*(By courtesy of Poultry and P P S)*

Australorps are very suitable for crossing purposes, particularly with White Leghorns to produce the well-known Australian crossbred

RHODE ISLAND REDS

Rhode Island Reds have come into popular favour in recent years, and good scores have been obtained in various State egg-laying competitions Like Australorps, their carcass value is good after their laying life is over, and the egg colour is similar, but the risk of broodiness is usually greater They are reared similarly to Australorps, though they are somewhat slower in maturing, and average production falls possibly a dozen eggs or

so below the Australorp Here again the question of a suitable strain can be very important, for individual birds have laid well The feathercolour does not always followthe standard set (refer to Table 4, pp 73-4) The Rhode Island Red forms the basis of many excellent crosses—for example, with White Leghorns or with Light Sussex See also pp 69-70

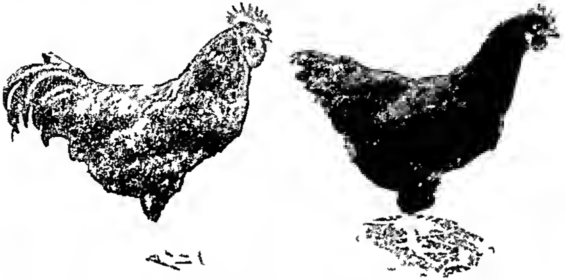


Fig 36 A popular heavy breed for utility purposes, with very good figures in laying tests It produces good, clean-fleshed table birds, being popular in the production of crossbreds, particularly for meat production The Rhode Island hen laid 241 first-grade eggs in its first season, and the male bird is of standard type —(*By courtesy of E.F S*)

OTHER HEAVY BREEDS

Other heavy breeds, such as Light Sussex, do not lay as well in Australia as in England Very little interest has been shown in Light Sussex in Australian egg-laying competitions, but as a table bird it is very good, and when used as part of a crossing programme the breed does very well Average laying results in competitions would indicate a level of 150 eggs per year.

Langshans are capable of high egg production, and good scores have been obtained in various egg-laying competitions, but large flocks are usually not kept It appears that with Australorps maintaining such a high level of production, Langshans cannot compete with them when egg production is the main avenue of return In competitions, from a limited number of birds 190 and over eggs per bird have been obtained

Wyandottes, Plymouth Rocks, and other heavy breeds were popular in the early years of the poultry industry, but are kept on only a very limited scale in Australia today

PRODUCTION AND BREEDING OF CROSSBREDS

Crossbreds are popular throughout Australia Their laying performance in recent Random Sample Tests indicates a margin of 2 to 3 dozen eggs above the performance of pure breeds Breeding standards for crossbreds are high and the excellent results usually obtained are due to the use of pure-bred stock with a good background

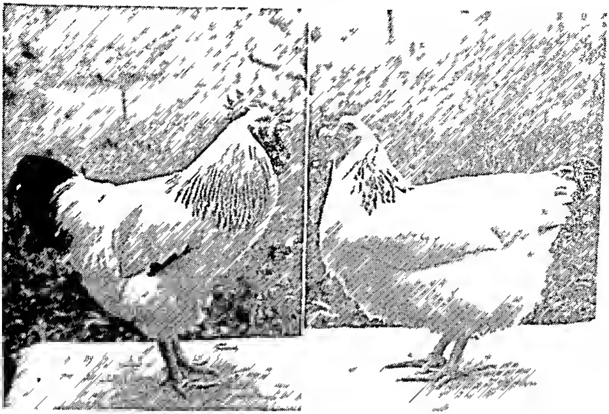


Fig 37 A well known utility breed, Sussex produces excellent table birds They have also been used as the basis of excellent crosses for meat production especially when crossed with Rhode Island Reds The cockerel and pullet are of standard type —*(By courtesy of A C E)*

The male birds should be from a high production line Defects in comb, feather, or eye colour are not important to laying results, which will be in direct ratio to the laying background of the birds on each side of the mating Crossbreds do not lay well just because they are crossbreds—they obtain a boost in lay from hybrid vigour, but their laying performance depends on the strains crossed The question of breeding from pullets for crossbred production is one that frequently arises it is suggested that a well grown spring hatched pullet laying a good sized egg by May and checked for early rate of lay will be quite suitable for breeding of good crossbred stock They should be bred from tested family lines that have a low mortality record

For ordinary commercial purposes a first cross between two high producing strains of different breeds is the normal practice, and good results are usually obtained The increased lay is obtained merely by crossing the two birds (In one phase of breeding the worth of male birds is evaluated by the performance of their crossbred progeny—as with purebreds Some have used a male with two breeds of hens in the pen, one for the pure line and one for crossing "knicks")

Under ordinary husbandry the vigour in the young stock gives good rearing results and high laying performance Many excellent scores have been and are being obtained in egg laying tests, both in Australia and overseas, from first-cross breeding, particularly with White Leghorn x Australorps In America hybrids that have given a high average performance are produced by very close in breeding for a few generations and then crossing between these lines, but the processes involved are extremely

costly and only a very big organization with large financial resources could carry them out The system followed is somewhat akin to that used in the production of hybrid corn Multiple testing of the large numbers of in bred lines needed involves great expense, and the cost of the chickens is necessarily very much higher than for first cross or pure-bred chickens The process is not within the scope of the ordinary Australian commercial farm

The Commonwealth Scientific and Industrial Research Organization carried out valuable work on breeding at the Poultry Research Centre, formerly at Werribee, Victoria The work involves much statistical recording and requires single testing facilities and trained geneticists They have shown a marked increase in egg production due to crossing Work by Morley and Smith on first-cross breeding at Seven Hills Experiment Station, New South Wales, has shown that the broodiness level is higher in Australorp male x White Leghorn hens than in the reverse mating

In view of the extensive work involved in breeding and the fact that only ordinary facilities are available on a commercial farm, the poultry farmer should concentrate on the production of first cross crossbreds only When

Fig 38 The crossbreds are from a mating of Australorps and White Leghorns, from which excellent rearability and high production averages have been obtained They are kept on most sideline and commercial units today Production levels usually exceed those of the parent lines by $1\frac{1}{2}$ to $2\frac{1}{2}$ dozen eggs per year

two strains are found to "knick" well, they should be used to the fullest extent Keep the standard of the stock on both sides as high as possible, with emphasis on a known family record A hatchery with several suppliers can cross between these to find the best crossbred combination (this can be a valuable contribution to breeding improvements)

SOME SUITABLE CROSS-MATINGS FOR EGG AND MEAT PRODUCTION

The breeds mentioned on p 64 are those commonly used as the basis for crossbred production The combinations for egg production and also meat are between White Leghorns and Australorps both ways, Rhode Island Red with White Leghorn both ways, and also with Sussex Other crosses can be attempted between various breeds, but large numbers of chickens are needed for this, which means that breeds available on a large scale are required, and this narrows the field for selection

White Leghorn Male x Australorp Hens

This excellent cross has given performances of well over 250 eggs a year per bird (see pp. 62, 76) and good flock performances are obtained The rearability is good, and the broodiness level with floor-litter systems is lower than with the reverse mating The pullets are white-legged and carry very few dark feathers, having nearly all white plumage They usually weigh nearly 4 lb at start of lay, and 5 lb at end of pullet season The eggs are off-colour Production usually begins about 5 to 6 months of age The carcass value is higher than for White Leghorns The pullets of this cross perform well under intensive conditions and in cages The cockerels are clean-skinned and light-legged and are very suitable for table production

Australorp Male x White Leghorn Hens

This cross has given performances as satisfactory as the reverse (or reciprocal) cross Rearability is also good With floor-litter systems the broodiness level is higher among this cross than among the reverse cross, but it is not noticeable in laying-cage systems The pullets are black-legged and carry a number of black feathers among the white plumage The eggs are off-colour The carcass weight is slightly higher than with the reverse cross This cross does well on open-range conditions or under intensive conditions The cockerels are clean-skinned and light-legged, as with the reverse cross, and they are heavier (Some sideline operators use the leg colour of the pullets for identification by purchasing the reverse cross in alternate years)

White Leghorn Male x Rhode Island Red Hens

This cross produces a very good bird if the parent stock is good The cross is capable of a high-level production of 200 and more eggs per bird annually in flocks that are given suitable conditions It does not follow a set colour-sequence, and variations will occur, from a few red feathers among the white plumage to a high percentage of red feathers The eggs are an off-colour light-brown Broodiness is evident during the warm months of the year where floor-litter systems are used The cockerels from this cross are highly suited for table production, being very clean-skinned and light-legged The weight of the pullets and cockerels is equal to that of the heavy breeds, but the quicker growth from the White Leghorn side is a big factor in costs The reverse cross also gives satisfactory results when good Rhode Island Red males are used

CROSSBREDS FOR COLD LOCALITIES

Crossbreds can be successfully kept intensively, and the White Leghorn male x Australorp hen cross will give slightly better results than other crosses Crossbreds are particularly well adapted to cool or high-rainfall areas (over 30 inches) and should do better than White Leghorns under these conditions Like Australorps, they do well on outside range also, and are very adaptable to open-farm sideline units Roosting quarters plus an ample free-range area will give very good results They are also well suited to laying-cages

New Hampshire x White Leghorn

This cross has given good laying results and comparable production under test with other crosses The birds are hardy in the rearing stages The cockerels make good table birds

Rhode Island Red Male x Light Sussex Hens

This cross has produced very fine table birds, both pullets and cockerels being suitable for this purpose Egg production from the pullets of this cross is not very high The reverse cross produces excellent table birds with very good flesh characteristics Further reference is made in Chapter 18.

PLACE OF CROSSBREDS IN THE COMMERCIAL FIELD

Well-bred crossbreds have good rearability and are capable of a very high rate of egg production They have performed well on open range or under intensive conditions The crosses described can be expected to give very good results, and a hen-housed flock average of 200 eggs is more than possible with crossbreds, exceeding our present pure-bred Australorp and White Leghorn strains Many groups in Australian Random Sample Tests have exceeded 250 average lay per year The results of the 1953 4 survey of the Bureau of Agricultural Economics, Canberra, showed a high level of performance on farms with crossbred stock Reference is made in Chapter 17 to production figures on the farms sampled in the survey Crossbreds produce cockerels that are excellent for table poultry

Criss-cross Breeding

Criss-cross breeding involves the use of White Leghorn and Australorp males alternately with the crossbred progeny from the previous mating This subject is discussed by F. Skaller, formerly of the Poultry Centre, Werribee, in an article entitled "Heterosis from Criss-cross Breeding in Poultry", in *Proceedings of the 10th World Poultry Congress*, Edinburgh, 1954, pp 59 64 (This system has great value, and produces excellent laying stock, particularly suited where supplies of pure bred females are limited A variation for commercial use which also increases supply of stock, *and* reduces costs due to use of pure breeds, because of their lower rate of lay, is to mate White Leghorn males with the progeny from the White Leghorn male x Australorp female mating This produces excellent white feathered stock. It also means that it is only necessary to carry a limited number of White Leghorns and Australorps to act as foundation stock each year)

The use of these procedures, coupled with the vigour of crossbreds and their increased egg output, makes them ideally suited to the needs of developing countries—*particularly* for the village and agricultural areas For further data see also Appendixes 7 and 8

VALUE OF SINGLE-TEST EGG-LAYING TRIALS

Single-test egg laying trials formerly conducted in various States have been of great value to the poultry industry in Australia Breeders have made their reputations in these tests The standards set formed a yardstick for efficiency in the industry

At a competition field day M D Hall, former Chief Poultry Expert of Victoria, cited the names of a great number of breeders whose entries consistently attained very high production figures R Tabart, former Chief Poultry Officer in Tasmania, has also pointed out the high level of production with pullets in the former Newtown Competition over a number of years These and other competition results lend support to the claim that Australian breeders can produce stock that compares well with any other country's

VALUE OF RANDOM TEST TRIALS

A stage farther in the testing of stock has been reached in the various States of Australia with the use of random test trials The previous type of single tests concerned the testing of adult stock during the laying period

Fig 39 Team of 6 White Leghorns that laid 1472 eggs of first grade size in the 1953-4 Official South Australian Test

only Very comprehensive Random Sample Tests are now being run by the various States The results of the top group entries, particularly the crossbreds, are excellent This shows the high production level of Australian stock when bred on modern scientific lines In some tests data is collected for the hatchability of eggs and for the rearability of chickens to laying stage, and in other tests for rearing from day old-chicken stage only

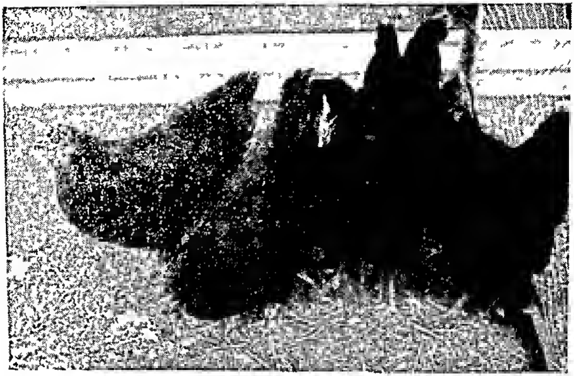


Fig. 40. Team of 6 Australorps that laid 1417 eggs of first-grade size in the 1954-5 Official South Australian Test.

Data is also gathered on egg-laying ability of birds reared and tested in groups, as well as data on performance of entries under both floor and cage systems. Valuable facts relating to feeding costs, the effect of mortality on costs, and returns to be expected for stock and eggs for the test period are made available to the industry through these tests. They cover a much wider field than the standard type of single-test competition and the results are more significant.

One of the features of the trials was the high rate of lay from flocks comprised of ten-bird pens in South Australia, twenty-bird pens in Victoria, and forty-bird pens in New South Wales, the excellent annual average production of 200 and more per bird for pure-breds and cross-breds having been obtained. V. H. Brann, former Principal Livestock Officer (Poultry) of New South Wales, commenting on the 1957-9 Random Sample Laying Test, said that under good conditions disease problems are not a big factor, and that with good management young stock can be reared with a remarkably low percentage of losses as only 3½ per cent were lost to 12 weeks of age.

Mr W. Stanhope, Senior Poultry Officer, Victoria, has also indicated excellent results with only 1·6 per cent loss to 17 weeks of age in the 1961-3 test, and Mr R. Booth, former Senior Poultry Officer, Tasmania, reported under 5 per cent loss to laying stage in the 1961-2 test.

The groups whose average lay is in the top sector of the test, rather than the individual winners, will indicate the best sources of stock. This applies particularly when replicate pens for the layers are used and results are based on laying performances over a period of three or more years.

A point of interest in relation to returns during the high-price period for eggs is the very good laying obtained in small-pen units during the

TABLE 4

UTILITY CHARACTERISTICS

Breed	*Head*	*Body*	*Weight and plumage*	*Points for breed*
White Leghorn	*Comb* single and of fine texture. *Face* bright red. *Wattles* red, long, thin fine texture. *Eye* bright red and prominent.	Deep oblong wedge appearance. *Back* medium and broad. *Abdomen* with plenty of space between breast-bone and pelvic bones.	Cock 6 lb., cockerel 5 lb. Hen 5 lb., pullet $4\frac{1}{2}$ lb. Colour of plumage pure white (avoid straw tinge if possible). *Tail*—At an angle of about 45 degrees.	Comb, lobe, wattles, beak, neck, face, and eyes .. .. .. 22 Type and carriage .. 30 Plumage—tightness and feather density .. 20 Legs, feet, and tail (5) .. 8 Colour, including plumage, beak, eyes, face, feet, and lobes .. 10 Condition and size .. 10 100
Australorp	*Comb* single, medium fine texture. *Face* bright red, clean. *Wattles* bright red. *Eye* bold and full, black or dark brown.	Wide and deep. *Abdomen* deep and broad, with ample space between breast-bone and pelvic bones	Cock 8 lb., cockerel 7 lb. Hen 6 lb., pullet 5 lb. Colour of plumage black throughout with beetle-green sheen or lustre (free of purple barring) *Tail*—At an angle of about 30 degrees.	The Australorp standard as set by the National Utility Poultry Breeders Association: Type .. .. .. 30 Head (eye 10) (face 5) (skull 5) (comb and wattles 5) .. .. 25 Plumage . .. 12 Texture and freedom from coarseness . 20 Condition . .. 8 Legs and feet . . 5 100

TABLE 4—*continued*

UTILITY CHARACTERISTICS

Breed	*Head*	*Body*	*Weight and plumage*	*Points for breed*
Rhode Island Red	*Comb* single medium, five serrations. *Face* bright red, clean. *Wattles* bright red. *Eye* bright and red.	Deep oblong. *Back* broad and long. *Abdomen* with ample depth between breast-bone and pelvic bones.	Cock 8 lb., cockerel 7 lb. Hen 6½ lb., pullet 5½ lb. *Male plumage*—Rich brilliant red (except where black is specified). Deeper red on wing bows and back. Rich under-colour is desirable; should be red; at base of tail should be red or salmon. *Female plumage*—Surface colour lighter red than the male—should be even, rich shade of red. The under-colour should be red or salmon. *Tail*—At an angle of obout 30 degrees.	Skull, beak, neck, face and eyes, comb, lobe, and wattles .. .. 22 Type and carriage .. 25 Plumage—tightness and density .. .. 20 Legs, feet, and tail .. 8 Condition ond size .. 10 Colour including plumoge, lobes, beak, eyes, face, and feet .. 15 100
Light Sussex	*Comb* single medium, five serrations. *Face* smooth. *Wattles* medium size, red. *Eye* full and bright, rich orange.	Broad, deep, long. Square breast, wide shoulders. *Back* broad and flat.	Cock 8½ lb., cockerel 7½ lb. Hen 7 lb., pullet 6 lb. *Plumage* pure white with black-striped neck hackle; black in flights and black tail; black centre of each feather on neck hackle to be surrounded by a white margin. *Tail*—At an angle of about 45 degrees. *Legs* white (with pink shading in order).	Skull, beak, neck, face and eyes, comb, lobe, and wattles .. .. 22 Type and carriage .. 25 Plumage—tightness and density .. .. 20 Legs and feet .. .. 3 Tail .. .. .. 5 Condition and size .. 10 Colour including plumage, beak, eyes, face, feet, and lobes .. 15 100

winter months, from April to July The rate of lay in the random tests for all entries during this period in New South Wales has exceeded 48 per cent, and in South Australia for the 1958-60 test it exceeded 62 per cent for all breeds under natural lighting conditions

These random type testing facilities are a valuable aid, indicating the performance of stock from various sources under uniform conditions, so that Australian poultry farmers can buy from the best sources available The tests also serve as a medium through which to evaluate the improvement of egg laying and other factors of various strains, breeds, and crosses

STANDARDS FOR UTILITY BREEDS

A brief discussion of the standards for utility breeds is necessary here The standard for each breed is given in Table 4, and represents the perfect bird, though this high level is seldom attained it is a guide for the commercial farmer and is used as the basis for judging at exhibitions

Utility poultry should not only conform closely to breed characteristics but have the qualities needed for a high rate of egg production Standard (open or fancy classes) birds are not included

The points that mainly concern the commercial breeder are those of head, body capacity, type, and weight A scale is given showing these points

Specialist breeders' clubs exist in the various States, and those who desire to specialize in a particular breed should get in touch with the local headquarters of these clubs

The breeds included in the following list are those that are commercially the most popular, and they are also used for the majority of the crossbreds in the poultry industry *

SUMMARY

1 The most suitable breeds available in sufficient numbers in Australia for commercial practice are White Leghorns and Australorps Combinations of these two breeds give the best crossbreds for commercial egg production Rhode Island Reds are also suitable pure breds for crossbreeding with the other breeds

2 The level of performance of the best crossbreds in Australia is now proven, and they are particularly suited to needs in Australia *and* in developing areas

3 Random sample tests have an important place in the industry, for they serve as a guide to hatching, rearing, and egg laying ability They are also a guide to sources of stock, costs and to husbandry practices

4 The utility breeds standards serve as the basis for some desirable features in breeding

* For those concerned with the showing of poultry a useful publication is the *New Zealand Utility Poultry Standards of Perfection and Breeding of Poultry* (1953) This is available from the New Zealand Department of Agriculture Full details are given in it of preparation of birds for show, complete judging points, and other necessary information that is essentially for fanciers and specialist breeders, and not within the scope of a commercial poultry keeping book

5. Given good husbandry, the consistently superior lay of crossbreds,† and also purebred performance, will be decided by the breeding background.

6. The rate of lay in the various Random Sample Tests has indicated the high performance possible when layers are housed in small groups.

Valuable information is also being made available on the performance of stock under various methods of housing, as a portion of samples being checked are being tested in cages, as well as for groups in the deep litter floor pens. An indication has also been given, by the results quoted covering the improved performances with large-group samples, of the advances made in the genetic background to stock in Australia with the new breeding techniques. These, in the main, arise from the work of the C.S.I.R.O. Poultry Research Centre. *The Random Sample Test results quoted here are from birds bred on these lines. The basic technique of operation is given in Chapter 6 and Appendix 7.*

CHAPTER 6

SOME BREEDING PRACTICES

THE work of breeding demands skill and conscientious work The Australian poultry industry generally is greatly indebted to those who have been responsible for maintaining high breeding standards, both specialist breeders and clubs The efforts of the best of them have resulted in stock whose laying performance compares favourably with any in the world

If the commercial breeder observes certain simple rules for breeding practice, he will find an improvement in laying performance, or if he already has a line of poultry with a good laying record he will find it easier to maintain this at a high level Good stock from a reputable stud breeder has often been observed to deteriorate after a few generations because rules for maintaining it at a high standard were not observed These simple recommendations for commercial practice are offered

1 Select a breed such as White Leghorns or Australorps, and concentrate on body egg size and egg laying features This avoids feather colour problems

2 Assess the value of males and females by observing the records of their progeny Facilities for testing a sufficiently large sample of birds are needed, otherwise very little can be achieved in the way of improving a breed for egg production

3 Breed the stock from families of high livability (or viability), in order to produce laying stock with low mortality combined with good egg production, by the use of part-time records

4 The minimum weight of eggs for incubation should be 2 oz when from mature stock, and they should have good, sound shell texture When pullets are used their eggs should reach this weight by June if early hatched The eggs must also be of good internal quality

5 Observe the standard requirements of the breed when selecting birds for initial testing as layers and when choosing male birds for breeding purposes

6 For testing purposes use suitable single pens, laying cages, or small group units (the latter can also serve as breeding pens)

We shall now take each of these simple recommendations in turn, and enlarge on them when necessary

BREEDING MAINLY FOR EGG PRODUCTION

The complications of feather breeding (e g double mating for feather patterns for male and female) call for concentration on features not directly associated with high laying rate The eggs are the main consideration of the commercial poultry farmer so it is suggested that straight'

breeds such as White Leghorns or Australorps are best suited to commercial practice, rather than multicoloured ones. As a general rule, to achieve breeding progress it is necessary to concentrate on one main feature—apart from conformation to type and characteristics for the breed. If egg production is sought after, it will be at the expense of meat production, and vice versa. Feather problems will complicate matters still further, hence recommendation numbered 1 above.

Fig. 41. A progeny-tested White Leghorn male, whose daughters from the hens he was mated with averaged 225 eggs per bird. Note the dubbing of the comb as shown is a practice that is helpful to fertility with breeding males.

ASSESSING THE VALUE OF A MALE BIRD AND OF A *FAMILY*

The value of a male bird can be decided under commercial conditions only by the results obtained from his progeny, and these results can serve also as a family test for male and hens. This means testing the pullets in single pens (or laying-cages) when data on egg-size and laying performance for individual birds are required, or testing in small groups of ten or twelve pullets to obtain an average. Testing of two or three sample groups like this for each family will serve quite well. If a large percentage of the eggs are small the male bird and family should be rejected for this fault. Results are improved if portion of the family groups can be checked singly, so that cockerels come from females of known egg-size within the best families selected. Alternatively practise heavy selection when setting eggs. When a family of a male with several females by means of progeny-testing are found capable of producing pullets that will give a high average lay, they should be used as much as possible and for as long as practicable, because of their value for replacement breeding. Cockerels produced from the same parents in a single mating—i.e., full-brother cockerels—can produce pullets with widely varying performances. So male birds and families must be proved by the performance of their progeny, and only the best family lines retained. A method of testing is described on pp. 88-90.

BREEDING FROM MATURE STOCK

Divergence of opinion now exists among breeding authorities in various countries on the question of the age of the stock to be used for breeding.

Breeding performance of a pullet is an unknown factor unless it is bred from after a part winter test, which will be a good indication of its potentialities The factor of livability can be a gamble if the average results of a family line (determined from sufficiently large sample numbers) are not known Some of our best breeders in the past have used birds of two, three, and up to five years of age for replacement stock: the families had proved to be capable of producing stock with low average mortality, good egg-size, and high egg-laying ability The factor of small eggs can be overcome by pullet breeders who select carefully for the features of lines which quickly reach desired egg-size and body-size on part winter test lay, and also select from a known resistant line for leucosis

Pullet breeding is sound if checked as above, because the inheritance level of disease is low Many veterinary and breeding authorities have told us that leucosis or fowl paralysis, which is spreading in Australia, may be transmitted by breeding Although no certain cure is available, a recommendation for control is to breed from known resistant families to produce resistant strains, and to keep young stock in complete isolation from adult birds, particularly during the first three months of their lives For further information on leucosis refer to T G Hungerford's *Diseases of Poultry*

Other factors as well as leucosis which can be covered, even when part-winter testing is used, are broodiness—*by checking the breeding families while the progeny are being part-winter tested*, and also the ensuring that breeding rations have normal levels of minerals and vitamins to prevent raising stock with unduly high requirements for these The breeder has his own welfare at stake in ensuring that his replacement stock is good, sound stock, and all who supply hatcheries with fertile eggs have their own and the industry's stability in their hands, for all become involved if payable production is not obtained from the chickens

EGGS FOR SETTING

Eggs for setting in the incubators must be of good texture, uniform in shape, and should not be smaller than 2 ounces Size is very important It is a highly heritable factor, and stock that is expected to lay eggs of a good size must have been produced from a line that has maintained that factor. Egg sales at home and overseas depend upon quality, and small eggs do not encourage sales It is not an economic proposition to have a strain of birds with high lay but small eggs—returns are better from a strain with reasonable lay and good-sized eggs Eggs are sold on weight on all markets

Texture is very important unless this is good the egg will not reach its destination—the consumer Thin- and poor-shelled eggs cost the industry many thousands of dollars, some are lost in the nest, others in collection; a number are lost in the cases, and others when handled for the incubator or on the egg-floors, or by the retailer Therefore it is imperative to select for incubation eggs of good texture and uniform size and shell colour

Apart from size and texture, there is the important matter of the content of the egg If possible, eggs should be candled (checked against a light to show the contents) before setting The internal quality is a matter of breeding as well as of correct nutrition This factor is discussed in Chapter 14

Birds lay a certain weight of eggs, a high rate of lay but with small eggs poses market problems Good-sized eggs are vital for payable returns

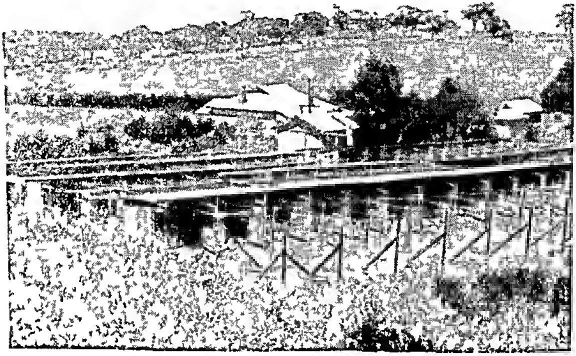


Fig 42 A farm employing progeny-breeding practice The breeding pens (with or without runs attached) are suitable for family breeding work (For a more suitable type refer to Appendix 7 for plan and details)

OBSERVING STANDARDS

It should be realized that, apart from the commercial aspect, a feature of breeding work is the pleasure and satisfaction that can come from the sight of an even flock of birds that are true to type It is necessary that the standards evolved for a breed be considered as the basis for selection of stock, whether layers or male birds The utility type for the particular breed is the standard Breed standards have been set as the result of long experience, and the type and size are important for example, a marked deterioration in body-size so that it is below the standard will mean a consequent fall in egg-size. This can be checked with the initial selection. In selecting male birds standard can be combined with the pedigree record.

PENS FOR BREEDING WORK

It is not possible to breed stock if the only facilities on a farm are large pens An experienced poultryman can select his stock, and he may be able to maintain good results because he has started with a good line of stock

Accordingly, in order to prove the value of particular male birds and families and achieve progress, it is usually necessary to use suitable pens for the work: these can be (*a*) single testing pens, (*b*) battery cages, or (*c*), small pens 8 by 6 feet for ten to twelve birds By these means it is possible to test individually the daughters of a male bird and family in the first two cases, or to group-test them in the third case for average lay The details of these types of pens are given in Chapter 12

A BREEDING SYSTEM

The foregoing suggestions outline the case for having a good breeding background for improving egg-laying averages Feeding and housing are very important, but breeding must be good, and this has been clearly illustrated by the results obtained in random sample tests When all the birds are given comparable rearing and housing a wide variation occurs in laying results of different strains The breeding system suggested here is given in as simple a manner as possible, so as to be capable of adoption on a commercial farm by a breeder—who could then in turn supply a "multiplier" (who mates stock with males from a known breeder) supplying fertile eggs to a hatchery. Single matings, extensive testing of all breeders, artificial insemination are the province of very extensive breeding establishments, large stud breeders, and research stations

Proving the Worth of Male Birds and Families

Mate one male bird to a pen of twelve to fourteen birds in each of several pens—at least ten pens and if possible more If possible, select the males from females tested for rate of lay (or purchase from a stud breeder) this makes for an easier start, since some history of performance is available. It may be found that culling of cockerels for various external selection points will result in possibly only one male bird being left from every four hatched Random selection gives a sound start

Qualifying Standard

To qualify for selection for further work in the breeding programme, the stock bred from the male bird and females should reach certain standards, as follows

(*a*) The eggs from a pen being tested should give a hatchability of 75 per cent of all eggs set. Identify the chickens by toe-punching or wing-banding. If fifteen pens or fewer are being used, toe-punching is an easy method of identification.

(*b*) The rearability of the chickens, under good rearing conditions and making allowance for any accidents that might occur (e g foxes, heat-waves, or cut-off water-supply) should be at least 80 per cent—preferably 90 per cent—of chickens placed in the brooders up to laying stage

(*c*) The laying of the daughters to be tested from each pen, with a minimum of twenty pullets (more if possible), should be not less than 180 to 200 eggs of good size if tested for a full year, it is desirable that there should not be a wide variation in the scores of the half sister pullets tested.

It is economically important that good egg size be reached quickly—2 oz eggs by about 8 months of age should be the aim

For the part-winter test at the start an average of 40 eggs is desirable by 31st May from the first egg laid when hatched early September (At later stages this may be 60 or more)

USING MALE BIRDS

When the worth of a male bird is proved, it could be used for breeding of replacement stock The technique of artificial insemination is rather difficult for the commercial man, being more the province of a research station such as the C S I R O Poultry Research Centre, or a large breeding establishment with the necessary staff and equipment Where single-unit breeding pens are available, a male bird could be mated with three breeding-pens and moved on every second day An easy way of checking is to have a plate on the front of the pen giving the day on which the male should be in the pen For example, on three successive pens

Pen 1	Pen 2	Pen 3
Monday and Tuesday	Wednesday and Thursday	Friday and Saturday

then recommence the sequence (The extra day in any pen should not particularly matter whether in pen 3 or pen 1) This would apply only for replacement stock and not in the breeding set-up

The same technique can be used for single mating by moving a male each day if mated with seven females when using single test-pens It is possible to increase the supply of males and families by using a pen more than once in a season The procedure involves replacing a male during the breeding period The pullets produced are then treated as two separate families The first male is removed from the pen on, for example, Wednesday, and the eggs from the pen are used until Monday and credited to the first male The second male is placed in the pen on Sunday and the eggs from the pen are marketed from Tuesday to Thursday On Friday the eggs are taken for hatching and credited to the second male from then on

WINTER LAY TEST

When families are used during a breeding season it is natural that some knowledge of results will be desired before the next season, or a considerable period of time would be lost In the case of good families this means that a valuable year could be lost by waiting for a twelve-month test of the pullet progeny Statistical analysis has shown the possibilities of adjusting the time-lag by working on the winter performance of the pullets Testing pullets hatched during August to September for the period April to July will be a very good guide to the production for the year This substantiates the work carried out at the C S I R O Poultry Research Centre on these lines In an official test with 245 birds (135 White Leghorns and 110 Australorps) over a year in single pens, there was over 90 per cent accuracy in this forecast April and May laying figures would be known before it became necessary to mate the breeding pens for a normal spring season, and a family line where pullets laid an average of 35 to 40 eggs

by the end of May, with an average starting weight of just over 1¼ oz., could be used in the next season. (For egg-size refer to "Short Term Records of Egg Weights can aid Poultry Breeders", published in *S.A. Journal of Agriculture* 61:348 (February 1958 issue) by A. A. McArdle and K. M. Cellier. This indicates that the weight of first 10 to 20 eggs laid by pullets is an accurate indication to weight of eggs for the year, and if first 10 average over 1.8 oz. and the first 20 average over 1.9 oz., then all eggs for the year should average over 2 oz.) The full winter test with 30 to 35 additional eggs for June and July should give 70 eggs in single or small-group pens, under unlighted conditions to prove their potential ability. (If egg-recording is difficult to arrange, two successive days' weighing per week is a sufficient guide to size.)

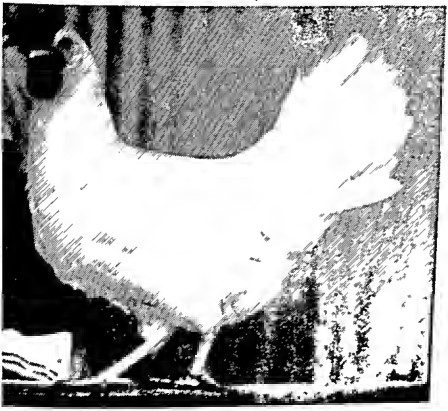


Fig. 43. Young White Leghorn pullet that subsequently laid 224 first-grade eggs for the year. This pullet was one of many high-producing daughters of the male bird shown in Fig. 41.

With Australorps it was found that over 90 per cent of pullets capable of laying 75 eggs by the end of this initial period, 1st April to 31st July (122 days), would exceed 180 eggs for twelve months, with a likely level of 220 eggs in the year, and over 90 per cent of those laying 87 eggs by the end of this period would exceed 200 eggs, with a likely level of 242 eggs. With White Leghorn pullets it was found that over 90 per cent of pullets capable of laying 70 eggs by the end of this initial period would exceed 180 eggs for twelve months, with a likely level of 212, and over 90 per cent of those laying 85 eggs for this period would exceed 200 eggs, with a likely level of 233 eggs. The statistical analysis showed a correlation coefficient, on a sample of 245 birds, of + 0.67 with White Leghorns and + 0.60 with

Australorps, with a 90 per cent efficiency level These references give a valuable lead in calculating likely egg-size and laying results, thus enabling early proving and use of more families in breeding improvement work

The work of testing is considerably reduced because four months' testing can be done instead of eleven to twelve months, and the best families be known by the next season

SELECTION OF FURTHER FAMILIES

When family lines have given good performances, further families for breeding are taken from their progeny For example, the best three families of each ten families would be used This is essential for breeding progress (For procedures see Table 5, pp 88-90, and Appendix 7)

TESTING OF FEMALES USED IN MATINGS AND IN BREEDING PRACTICE

It would be desirable that the breeders should be single tested for performance before being used, but this demands extensive equipment and recording facilities, and for this reason the emphasis for general use has been on family selection by group-testing For groups, some degree of selection can be made by observation If pullets under part-winter test are checked when lay starts, e g, March for early September hatch, then any individuals in each group not in lay can be banded (or have one lobe removed) This will make it possible, at the end of the period, to identify and remove these late maturing birds within those groups which may qualify as families for use

IMPORTANCE OF MALE SIDE OF MATING

If some hens in a pen fall below requirements for desirable characteristics, this will affect a few chickens only, whereas the male bird has an influence on every chicken produced from the pen, and he is the medium for passing on production capabilities to the pullets The value of the male in the pen has been assessed as very high, and this, on results obtained, would appear to be correct Therefore when purchasing a male remember that it is worth paying a good price for one from a reliable source This applies to those supplying hatchery eggs when purchasing male birds from stud breeders

REARING AND CARING FOR MALE BIRDS

Male birds should be reared separately under good conditions after leaving the brooder stage The normal practices of deworming and vaccination should be carried out

Dubbing

Another practice that improves fertility and vigour and reduces fighting is that of dubbing the male bird The weight of a heavy comb, particularly with White Leghorns, is a drawback, and although many successes have been obtained without dubbing, improved results have been noted with its adoption both for Australorps and for White Leghorns In addition, some White Leghorn males with large combs have difficulty in drinking.

if the waterer is outside the shed and it is necessary for male birds to drink through a hole in the wall or a grille or from a small bowl with a valve in the centre The large combs of some of the birds may be bruised, and they will often refuse to drink These birds will stand around looking sick (with dark combs), and will give poor fertility and possibly have to be replaced

The operation of dubbing male birds is not very difficult once one has become accustomed to the technique It is usually carried out at about five months of age (this can be varied a month either way for convenience) A cool day should be chosen for the operation, since the birds would bleed more profusely on hot days The whole pen must be done together, otherwise those left with their combs may treat their dubbed companions cruelly It is taken for granted that birds with loppy or very poor combs will be rejected Dubbing these would disguise the fact that such birds had faulty combs, but it would show up in their progeny

A pair of curved scissors is ideal for the operation, some use a razor, but scissors are easier to control Wear very old clothes for the work With someone holding the bird, cut along a line near the base of the comb about half an inch up from the bird's head It is not advisable to cut lower than this, and to go too high would defeat the object Hold one wattle at a time between the thumb and forefinger of the left hand and cut across fairly close to the neck Repeat for the other side The bird can then be released To stop bleeding some operators dip the head into pollard or into ash from burnt paper, but results are quite good without doing this Though the birds will look miserable for a few days, mortality is rare after this operation In a month or so the males develop a fine head rather like a game bird's

Handling Male Bird in Breeding-pen

All male birds should be weighed before being placed in the breeding-pen Also go over them for lice, and dust with an insecticide Recheck at intervals during the season Trim back the feathers near the vent with a pair of scissors if these are full and fluffy Trim the spurs on the older birds and file the ends smooth Watch their feeding to see that they get enough some chivalrous males will call the hens for feed but will not take it themselves A tin of grain set above the level where the hens can get at it sometimes helps, but the majority of male birds feed well when plenty of space is available at the feeders After a season, try to arrange to have single pens to hold valuable males, for they may be lost if fighting breaks out in flocks

RELATIONSHIPS IN BREEDING PROGRAMME

A question frequently asked is one concerning the degree of relationship that can be adopted in a breeding programme Close matings have been used to establish a strain On many large, well established breeding units new blood is introduced very seldom If introduced, it is tried out first to see if it "knicks" well Breeding pens have been headed, with good results, by a male bird that is the sire of the birds in the pen (father x daughter mating) Also some have the birds in a pen mated to a cockerel that has been bred from the pen (mother x son mating) These matings can be

sound if healthy birds are used for both sides, but care should be taken to check for loss of vigour, which occurs with in-breeding Avoid mating a male with his sister, for this is considered too close a relationship for ordinary breeding, although used as part of the system in producing hybrid lines.

The fixing of points in a strain is possible with line-breeding, but crossing between unrelated families would appear to be a sounder policy. (The recommended procedures are indicated in Table 5 and Appendix 7.)

THE AIM OF THE FAMILY-SELECTION METHOD

The adoption of these simple breeding suggestions can lead to marked progress, further advanced with individual selection This is specialist breeding, possible only for stud breeders or on a large scale on a very large plant, covering individual testing of all females, or at a research centre also employing skilled geneticists and having extensive testing facilities The greater the number of birds and families which can be used, the better is the chance of making significant progress The aim is rather to have a simple and easily handled method of obtaining a reasonably high level of production over a large number of birds This system of family-selection breeding will improve the stock used for egg production. The performance desired is as many birds as possible near or over the goal of a 200 egg flock-average from the pullets with reasonable mortality and good husbandry

The adoption of this basis of family selection can be expected to improve many of the sources of supply of eggs for hatching The use of the system is set out in table form at the end of this chapter and in Appendix 7

SUMMARY

1 Some simple recommendations are given for proving of families by the egg-laying performance of their progeny (half- or full-sisters), the advisability of using only the best families as breeders, and the use of quality eggs for breeding The importance of good egg-size being reached early is stressed

2 Pullets being tested should reach the qualifying marks set out in the table in order that the families be retained for further use The use of part winter or full winter test period production of a family can be adopted as a guide to enable the best families to be used in the next season.

3 Husbandry of male birds and of breeding hens is important to good fertility and hatchability.

4 The basis given should enable breeders to obtain improvement in a strain The object is a reasonably high overall level of production with a low mortality level This basis can improve sources of breeding stock and in turn suppliers of eggs to hatcheries ("multipliers") Large breeding establishments can be expected to achieve faster progress because of facilities and greater selection possible with large numbers used. Random tests assist in the evaluation and spread of the best lines

5. A table is given as a guide for breeding practice This should secure the best possible results with normal facilities on a good commercial unit.

DISCUSSION AND REFERENCES

Some points on testing periods are given The testing of pullets during the first-year laying period is the usual practice in egg-laying competitions Set periods varying from 48 to 52 weeks, or from first egg laid to a set date in the following year are used Recent practice in Random Sample Tests has been a 462 day period from hatching This makes possible use of one set of pens, with a short period between tests

Statistical analysis of the different periods of laying, carried out at the C S I R O Poultry Research Centre, has indicated the following When assessing the performance of all pullets hatched for the season the best period is from first egg laid to 31st March of the following year Where difficulties in housing space prevent birds remaining in the pens for this period, production from the first egg laid to 500 days of age from hatching is suggested, and this gives a high genetic correlation with the full period to 31st March This is covered in "Studies on the Assessment of Egg Production in Poultry Breeding Investigations" No 1, F Skaller—"The Optimal period for recording First Year Egg Productions", *Poultry Science*, vol xxxiii, No 1, January 1954

The reader is also referred to the *Australian Journal of Agriculture Research* 1956, vol vii, No 6, pp 630 9 (II J A Morris, "Heritability of Egg Production for Two part Annual Periods of Measurement and the Genetic Correlation between them") This is a valuable reference on the advisability of using part-time records It shows "early selection based on partial records to be approximately 1½ times as effective in producing genetic improvements as selection based on the full production"

Another valuable reference is "*Genetics and Its Importance in the Developing of High Producing Egg Strains*" by J A Morris, formerly Officer in-Charge C S I R O Poultry Research Centre This paper was presented at W P S A Symposium, Kootingal, December 1961

REFERENCE BOOKS ON BREEDING FOR GENERAL ADVANCED TECHNICAL STUDY

I Michael Lerner, *Principles of Commercial Poultry Breeding* (Manual I, University of California)

I Michael Lerner, *Population Genetics and Animal Improvement* (University Press, Cambridge)

Jay L Lush, *Animal Breeding Plans* (Collegiate Press, Ames, Iowa)

Morley A Jull, *Poultry Breeding* (John Wiley, New York)

F B Hutt, *The Genetics of the Fowl* (McGraw-Hill, New York)

Footnote The breeding system outlined, based on family selection can apply in other countries with equal efficiency It can aid countries developing poultry in the economy by forming the basis for maintaining levels of imported improved lines, for prevention of inbreeding problems and for providing crossbred stock for upgrading programmes with local poultry To further aid progress in these areas a more detailed step by step description has been given in Appendix 7

TABLE 5

A SIMPLE FAMILY-BREEDING SCHEME

Some breeding factors such as body-size and egg-size have a *high heritability* and can be improved by selection with individual birds. Egg production has a low level of heritability, and significant improvement in rate of lay can only be made by use of family averages using hen-housed egg production figures.

An example is given of a simple breeding set-up using family selection. No recording work is necessary other than normal daily egg-tables of the pens being used for testing daughters of a family. Ten breeding pens would be the minimum requirement to use sufficient stock to prevent in-breeding being a problem, but twenty pens would be better. The 8-foot by 6-foot intensive pens shown in Chapter 12 are ideal for this purpose—also for testing the pullets from each family in two groups. Each family would start with a male heading a pen with 12 females (this could be 10 or 14 females). The initial stock of 10 cockerels and 120 females could be taken at random from the general stock on the farm (at least 500 birds on the farm would be desirable for this system).

FIRST-YEAR PROGRAMME

Starting during normal spring breeding season

Mating	Pen 1	Pen 2	Pen 3	Pen 4	Pen 5	and so on up to 10 (or more)
	Male 1 with 12 pullets or hens	*Male 2 with 12 pullets or hens*	*Male 3 with 12 pullets or hens*	*Male 4 with 12 pullets or hens*	*Male 5 with 12 pullets or hens*	*and so on*
Hatching and rearing check. *Identify* chickens by wing banding and or *toe punching, e.g.*	Hatchability and rearing for this pen good with over 75% hatching of eggs set and rearing over 80%	As for 1. This check covers pullets *and* cockerels (Use random rearing procedures)	Hatchability low. Rearing low (65%), poor family. Discarded	As for 1	As for 1.	Use one or up to three hatches and only over a period of 1-2 weeks. This is desirable during August-September. This period *of time gives a nearly equal en*vironment for pullets being tested. Additional pullets hatched are retained to provide sufficient supply of stock when best families known
Test pullets for laying from each family (random selection from one to three hatches)	Test *at least* 20 pullets and 30 if possible from each mating	Test in at least two groups to overcome effects of environment (two groups of 15 or three of 10)	. . .	Test pullets as for 1	Test pullets as for 1	Retain 12-15 males (minimum) at day old stage from each family being tested—required only until best families are known. *Cockerels from other than three* best families out of ten can then be sold. This number should allow (after rearing losses) required minimum of four cockerels from each of three best families for next season

(2) *On the General Section of the Farm*

Take the best families tested in the previous seasons—males and females—from pens 1 and 4 and any other which qualified to make up the three best families out of ten These can be used for breeding replacement stock or hatchery egg supply, or can be disposed of to a "multiplier" (between the breeder and the hatchery) who is supplying fertile eggs to a hatchery. These families can be used for two seasons Also use any balance of pullets and cockerels in the replacement stock breeding-pens from these families if supply is available over and above the needs of the ten breeding pens

THIRD-YEAR PROGRAMME (FOLLOWING BREEDING SEASON)

Repeat operations as shown for second year aod continue this cycle each year

• When checking laying of pullets from up to three hatches taken it is necessary to review period from first egg laid up to 31st May—a further check at 30th June will increase accuracy The figures given are for 31st May—a good family of daughters should have laid at least a 40-egg average by 31st May and a 55-egg average to 30th June under normal conditioos. No further testing for the year need be carried out and the pullets tested can then be used for breeding The part-year test has been shown, by work carried out at the C S I R O. Poultry Research Centre, and elsewhere, as giving a very accurate guide to the full-year production, because of the high correlation between the two periods. It makes possible quicker breeding progress, because the best families are known before next breeding season This avoids loss of a season waiting for a full-year record.

COMMENT.

This type of breeding approach can be expected to give improvement in egg production with the addition of only some breeding-pens to the normal farm facilities. It also avoids heavy recording work If more pens can be used, heavier selection becomes possible· for example, if 20 pens are used cockerels could be taken from best three families of 20 and pullets from best six families of 20.

FOOTNOTE· For the specialist breeder using family plus individual selection (with a 200-bird flock as a minimum).

It is possible for the specialist breeder using full-sister families to achieve faster progress. It would be necessary to use trap-nesting with small pens or single-mating pens (or laying-cages with use of artificial insemination) and pedigree hatching. A minimum of six cockerels with six hens each, and taking a minimum of five daughters from each dam would give 180 pullets for testing representing 36 families. Selection could then be made from eight or nine best families for best individual pullets, and three best families for cockerels (provided that the cockerels are not from the same sire). Then operate in similar fashion to that used for the simple family-breeding scheme. The overall family averages from each dam, as well as the individual sister records, would be used for selection purposes. Matings between cockerels and pullets from the same sire must be avoided to prevent in-breeding trouble. Cockerels would also be mated with females drawn from as many families as possible (Four day-old cockerels retained from each full-sister family to give two cockerels from each of the three best families when part winter laying records known)

ACKNOWLEDGMENT.

Grateful acknowledgment is made to J. A. Morris, formerly C S.I.R.O. Poultry Research Centre, Werribee, for guidance and criticism.

For Further Reading.

The reader who is directly interested in further basic information on family selection breeding should obtain the C.S.I.R.O. Leaflet Series No. 21 on "Breeding Poultry for Higher Egg Production", issued Melbourne 1958

CHAPTER 7

METHODS OF OBTAINING STOCK

STOCK for a poultry-farm can be obtained in various ways One method that appeals to beginners is to purchase breeding birds and multiply according to requirements Under present-day conditions, however, such stock supply may be difficult, nor is this method satisfactory for an inexperienced person, for correct breeding practice is a difficult art, one for the soundly trained poultry-farmer only. Also, if you begin with a limited number of stock you are going to find the breeding season a very prolonged one. The method is not practicable for large-scale operations Chapters 6 and 8 give some information on stud-breeding practice and what it entails

Another way, which is popular with many people, is to buy pullets that are nearly ready to lay There will be quicker returns in the beginning, and less risk of losses during rearing (for the birds are almost reared when you get them) This is an economic method if you are fortunate enough to have a reliable source of stock at a reasonable price—but this is where the snag lies, for large supplies may not be available Yet there are many advantages in stocking with pullets that are nearly ready to lay, and later on I shall discuss the possibilities of this method from the viewpoint of both seller and buyer (see Chapter 8)

The purchase of day-old or month old pullets is the most common stocking practice amongst beginners in poultry-keeping Since the pros and cons of it are discussed in full in Chapter 8, it is sufficient to say here that, provided a reliable source of supply is available, this is the most economic method of all *if* the chickens are available in sufficient quantity near the time when you need them, and if you buy the pullets on the basis of quality and not of price eight cents more on a day-old pullet, for example, would pay well with superior stock—only six extra eggs per pullet would be needed to cover the extra outlay and to show a marked increase on farm returns (With month old chickens you can buy 8 to 10 per cent fewer than with day-old chicks—for naturally the mortality risk decreases as they grow older)

Incubation of fertile eggs as a method of starting a poultry-farm is not recommended, for supplies may be difficult to obtain, and the cost of incubator equipment is heavy Thorough experience in incubation practice is also essential

The poultry industry has grown to such an extent that enormous numbers of chickens are needed, and the large hatchery centres in all States are the best sources of supply. Buy your stock from a well-established hatchery—only a good hatchery with reasonably good stock would continue to operate on a large scale year after year The results of random sample tests are a guide to selection of stock Once again I should like to stress that it is worth paying for quality stock

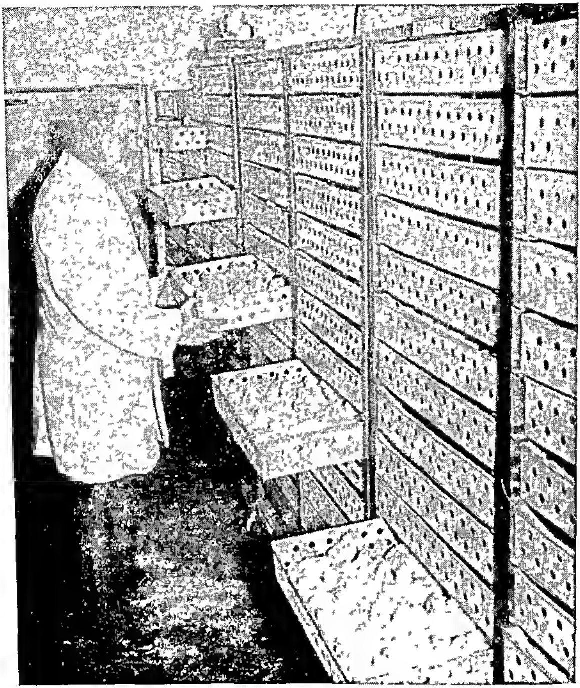


Fig. 44. Chickens at a hatchery. The industry's main source of supply is from hatcheries. Here chickens are being held in a warmed room after removal from the incubator prior to sexing and dispatch to customers. This avoids danger of chilling during cold weather.

PULLET NUMBERS

What percentage of pullets should be carried amongst the stock? There is very little option about this at the beginning—in the first year the farm will, of necessity, be an all-pullet one. It is after the first season that the decision must usually be made whether the farm is to be continued on an all-pullet basis, or whether the stock will include 50 or 75 per cent of pullets. This is often decided by the success that attended the first year's operations—and also by the finance available. To raise one thousand

pullets to six months of age (allowing for a reasonable mortality and with feed at two cents per pound) will cost approximately a dollar per pullet, or an outlay of $1000 Although the cost of sheds and plant can be pared down, the purchase price and the feeding cost cannot be reduced to any appreciable extent Provision must therefore be made for these costs when you are planning a farm and deciding upon the number of pullets to be reared If the 50 per cent pullet farm is adopted, approximately 550 to 600 day-old pullets will have to be bought for every thousand layers —this will allow for normal rearing losses and for losses due to light culling In the second season the process would have to be repeated, so that a unit would not become fully productive until eighteen months or two years after establishment—depending on whether the poultry-farmer starts operations at the beginning of the chicken season or five or six months before it

The brooding-plant and feed-shed must be erected and equipped before the stock is introduced, the laying-sheds can be built while the chickens are being reared To ensure quicker returns, every effort should be made to raise at least 75 to 80 per cent of the anticipated level of the farm in the first season

WHEN TO BUY CHICKENS

It is important to buy the chickens at the right time of the year Under normal Australian conditions July to September is the most suitable period, but to allow for climatic variations in different localities the period is best stated as June to October In low-rainfall areas (about 8 to 10 inches) with high early temperatures the chickens should be bought early in the season so that they are well reared before the temperature rise In districts with a heavy rainfall (over 30 inches a year) and in hill and mountain areas, buy the chickens later in the year—but not later than October (This may be varied in cage plants with regular replacements and adjusted light control)

The question will naturally be asked, "What is the ideal time to purchase the chickens in order to get the maximum return from them?" This is governed by the prices received for eggs, having in mind the normal seasonal price range in Australia, you should aim at getting the greatest possible number of eggs from the pullets from March or April onwards Under average conditions this means that heavy-breed chickens and cross-bred chickens should be hatched in August and White Leghorn chickens in September Breeders who entered pullets in egg-laying competitions beginning on 1st April usually hatched in these months

There are various reasons why chickens are best hatched in the spring

1. It is the natural breeding season, and breeding stock are usually in the best possible condition to produce healthy chickens, capable of good performance whether pullets or hens

2 Young stock hatched in spring receive all the benefits of the best months of the year, whether they are reared on open range or intensively On the open range they have the advantage of natural grassed areas and moderate temperatures before growth is steadied by high summer temperatures and dry rearing areas When stock are reared intensively their maximum

growth is attained before summer temperatures are encountered For these reasons, early-hatched layers mature and produce more quickly than those hatched at any other time of the year This growth factor also applies with cockerels

3 The rate of lay in the first year of production of early-hatched stock is the highest that can be obtained Pullets hatched at this time of the year from good stock and given good rearing conditions should produce well during the period of maximum prices for eggs Every dozen eggs produced in May can, under average marketing conditions, be worth approximately 8c per dozen more than spring produced eggs, and possibly 10c to 15c more (if sold on a wholesale or retail basis under permit) than springtime sales on the ordinary market basis These prices are based on average variations of recent trends over three or four seasons

4 Summer- or off season-hatched chickens are purchased about January to March, it would seem better to buy chickens at this time than to buy very late hatched stock (hatched late in the previous November or December, for example) because, under normal conditions, they would lay just as soon They can also maintain reasonable laying figures in their second year as compared with stock hatched in springtime Yet there are disadvantages in buying as layers pullets hatched in January to March (These comments refer to hatching times in Australia For tropical areas such as India it would be an ideal time) The disadvantages are as follows

(*a*) the pullets do not begin to lay until the spring months, when egg prices are at their lowest level owing to heavy production because all ages of stock whether cared for properly or not, lay well in the spring, the high prices for winter-produced eggs, therefore, cannot be taken advantage of,

(*b*) the pullets have only a short laying season in their first year, for they will moult at the same time as well-bred spring hatched pullets which began laying about March to April and kept on until the following March As a general rule, in the first year they will have only eight months' production as against twelve months for spring hatched pullets,

(*c*) with chickens hatched about January to March the risk of fowl-pox is much greater in the early stages, and vaccination has to be attempted earlier than is considered normal, coryza or colds may also be a problem in the early stages,

(*d*) dry rearing conditions for these pullets are usually experienced, possibly combined with high temperatures in the early days,

(*e*) the stock from which the pullets were bred are usually near the end of their laying season about January to March and are therefore less capable of producing vigorous chickens

Variations may be made to this basis on some laying-cage plants If carcass prices for culled birds are good, and heavy culling is being practised, then supplies outside the normal spring season will be needed to keep the plant at capacity This may mean hatches in, for example, June-September-March Similar moves may be needed to cover heavy losses in early rearing from spring hatchings, or if a unit is started too late in the year to obtain spring hatchings The best returns must be obtained

from the poultry unit—price trends decide whether by full or part year production, with or without heavy culling

RAISING PULLET PERCENTAGE

Using the production costs graph (p 30) and the calculations shown on p 31, an assessment can be made of the increased returns obtainable by raising the flock average of the farm The matter of correct housing, breeding, and feeding is covered in other chapters Given comparable conditions, the flock average and financial returns can be increased by carrying a higher percentage of pullets Returns from this practice will depend on the following factors

1 The prices payable for cull birds as compared with the cost of raising pullets If, for example, approximately $1 10 was received for culls, and pullets cost about $1 to raise, and normal mortality of 10 per cent was allowed for, no debit would be incurred. If 60c was received for culls and pullet-rearing costs were about $1, then a debit of approximately 35c per bird raised would be incurred on a farm stocked with 75 per cent pullets, and approximately 45c per bird on an all-pullet farm (allowing for the normal adult mortality rate of 10 per cent)

2 The labour of rearing the 50 per cent replacement stock that must be allowed on a poultry-farm is increased by 50 or 100 per cent according to whether the farm stock comprised 75 per cent or 100 per cent pullets

3 Extra rearing equipment—50 or 100 per cent more—will have to be installed on the basis of costs given in Chapter 3, this could mean from $200 to $400 per thousand layers for the extra equipment This increase in the rearing facilities is needed as compared with 50 per cent pullet replacement

4 If it is wished to carry out breeding operations with mature stock on the farm, 75 per cent would be the maximum advisable proportion of pullets, for 25 per cent breeding stock is required to allow for adequate culling and a reasonably short breeding season The all pullet farm is usually run only with the use of purchased stock, but breeding could be carried out with the pullets with part period testing

5 A flock average of approximately 165 eggs (approximately 1½ to 2 dozen higher than the general standard of 12 dozen suggested for a farm comprising half pullets and half hens) should be obtained from stock comprising 75 per cent pullets, allowing that the pullets will lay 170 to 180 eggs per bird (there would be approximately 120 eggs from old birds) On an all pullet farm the flock average should be expected to be from 170 to 180 eggs (approximately 2 to 3 dozen higher than the general average of approximately 144 quoted above) Laying is quoted on hen-housed basis

CHANGED PATTERN OF PRODUCTION ON ALL-PULLET FARM

A very important consideration is the time of occurrence of the increased flock average on an all pullet farm For example, let us take an increased flock average of 2 dozen eggs Under normal conditions where good

TABLE 6

COSTS AND RETURNS PER 1000 LAYERS ON THREE DIFFERENT PULLET-PERCENTAGE FARMS

50% Pullet Farm		*75% Pullet Farm*		*100% Pullet Farm*	
Returns per bird— 12 doz. eggs @ 38c. ..	$4 56	13½ doz. eggs @ 38c. ..	$5.13	14½ doz. eggs @ 38c. ..	$5.51
Expenses— Feed and working costs	$2.50	Feed and working costs ..	$2.50	Feed and working costs ..	$2.50
And replacement debit	25c.	And replacement debit ..	35c.	And replacement debit ..	45c.
		Depreciation on extra plant	2c.	Interest and depreciation on extra plant	5c.
	$2.75		$2.87		$3.00
Balance per bird per year	$1.81		$2.26		$2.51
Or					
Per 1000 birds on the unit per year	$1810		$2240		$2510
		$450 better than 50% pullet farm.		$700 better than 50% pullet farm.	

husbandry is practised one dozen or more of these extra eggs, or half of the total increase, are obtained during the production months of April, May, and June—always a difficult period on the normal fifty-fifty farm (half pullets and half hens) Egg prices are generally at their peak during these three months, so that the average price for eggs from an all-pullet farm (based on an average of 38c per dozen taken over the twelve months, and taking into consideration the normal seasonal rises) would be increased by over ½c and possibly 1c per dozen for all eggs produced over the year—the extra dozen eggs would be produced at the period when the ordinary market price received was 5c to 8c over the average price for the year per dozen for market sales, and would be at the higher level if sold on a permit basis figure Allowance is made for a lower price for some of the eggs (owing to the first eggs from the pullets being small ones) If the pullets are well bred and start with 1¾-ounce eggs, then the additional half cent to cent per dozen can be added to the example given below—this could mean an additional yearly amount of $50 to $100 per one thousand birds

In the following example, feed costs and working expenses would not vary for any of the farms, for the number of adult stock would be the same The basis taken here for the 50 per cent pullet farm is a possible one when replacement costs, feed and general expenses are $2 75 per bird The price of eggs taken as an example is 38c net per dozen, the price of culls 60c, and the cost of raising a pullet $1.

With Table 6 as a basis, any variations in egg prices can be readily taken into account Note that the sale of culls at a higher price, or a variation in the cost of buying and rearing a pullet, will affect the replacement cost

It can be seen that, provided the poultry-farmer allows for the extra labour and rearing cost investment, an increased return of from $8 to $13 per week per 1000 birds could be obtained on the basis of the above costs, for 75 and 100 per cent pullet farms respectively The all-pullet farm offers a means of combating high production costs or low egg prices by improving efficiency, without involving any marked increase in the capital cost of the farm

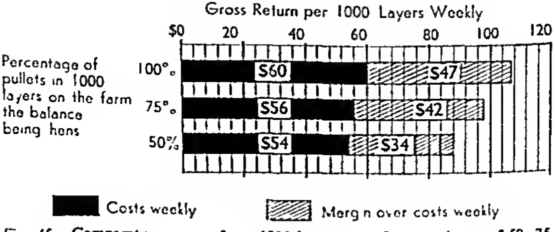


Fig. 45. Comparative returns from 1000 layers on a farm made up of 50, 75 and 100 per cent pullets

TABLE 6

COSTS AND RETURNS PER 1000 LAYERS ON THREE DIFFERENT PULLET-PERCENTAGE FARMS

50% Pullet Farm		*75% Pullet Farm*		*100% Pullet Farm*	
Returns per bird—					
12 doz. eggs @ 38c. ..	$4.56	13½ doz. eggs @ 38c. ..	$5.13	14½ doz. eggs @ 38c. ..	$5.51
Expenses—					
Feed and working costs	$2.50	Feed and working costs ..	$2.50	Feed and working costs ..	$2.50
And replacement debit	25c.	And replacement debit ..	35c.	And replacement debit ..	45c.
		Depreciation on extra plant	2c.	Interest and depreciation on extra plant	5c.
	$2.75		$2.87		$3.00
Balance per bird per year	$1.81		$2 26		$2.51
Or					
Per 1000 birds on the unit per year .. .	$1810		$2240		$2510
		$450 better than 50% pullet farm.		$700 better than 50% pullet farm.	

MORTALITY IN CHICKENS

The economic effect of mortality among chickens can be far-reaching, for it operates both directly and indirectly.

DIRECT ECONOMIC EFFECT

1 Each pullet lost during the early rearing period from day-old to six-week stage means a loss of the day-old-pullet cost of approximately 30c, and possibly of $1\frac{1}{2}$ to 2 lb of feed if the average period of loss was three weeks If feed costs 2c per pound this means nearly 5c making the loss 35c A loss of 20 per cent would mean $7 to be carried by the remaining 80 pullets, or nearly ten cents per head debit to be carried for the laying stage Higher mortality, which could be caused by very inefficient brooding or by pullorum disease, would increase the debit more than in proportion—e g, 40 per cent total loss on the same basis would mean 23c per head debit Under normal conditions the losses for this period should not exceed 10 per cent, this means a debit of approximately 3c per head—and many rear with under 5 per cent loss

2 A loss of 5 per cent from six weeks to near laying stage through disease or accident could mean, if losses occurred at an average age of 12 to 13 weeks, day-old cost plus approximately 12 lb of feed If feed costs 2c per pound then a total loss of 60c occurs, which means $3 for the five birds lost This would impose a further debit of 3c per pullet raised Under good conditions only 2 to 3 per cent may be lost, but losses could be heavy with troubles such as coccidiosis, and the debit would increase in proportion A loss of $2\frac{1}{2}$ per cent at this stage would mean only 2c debit A total loss of 25 per cent, with 10 per cent in the first period, would mean a debit of 13c to be carried by each pullet raised It can be seen, then, that *rearing mortality must be kept to a reasonable level*

A 25 per cent loss would mean that when rearing from 1000 day-old pullets purchased, a poultry farmer would have a debit of over $2 per week on the remaining 750 pullets in their first year of production If up to only $12\frac{1}{2}$ per cent losses occur to the laying stage—and this should be possible under good husbandry conditions—then a debit of under $1 per week would be incurred This also indicates that 1100 to 1150 pullets should be purchased where 1000 pullets are to be raised this allows for normal losses

With pullorum losses and with mortality from other diseases, if a total of 40 per cent of chickens were lost in the first period (this would be approximately 30 per cent above the normal number), the debit would be nearly 25c per head for the remaining pullets on the above basis, or $3 per week on the remaining 600 pullets, which is a heavy debit

INDIRECT ECONOMIC EFFECT

The indirect effect of losses amongst chickens is not only the value of the eggs lost from the pullets that have died, and a loss of cull sales, but also, if losses are above normal because of specific and preventable disease, a higher adult mortality rate than should have been the case, with resulting lowered egg production from the remainder. The disease could be.

1. Pullorum disease in the first three weeks, owing to the chickens having been hatched from non-tested stock infected with pullorum.

2. Coccidiosis resulting from stale, overcrowded, damp, or cold conditions during the three- to eight-week stage.

3. Worm infestation, usually at ten to twelve weeks of age, caused by lack of preventive treatment.

4. Coryza or colds caused by faulty ventilation, overcrowding, and incorrect feeding. The usual ages for these troubles are ten to twenty weeks.

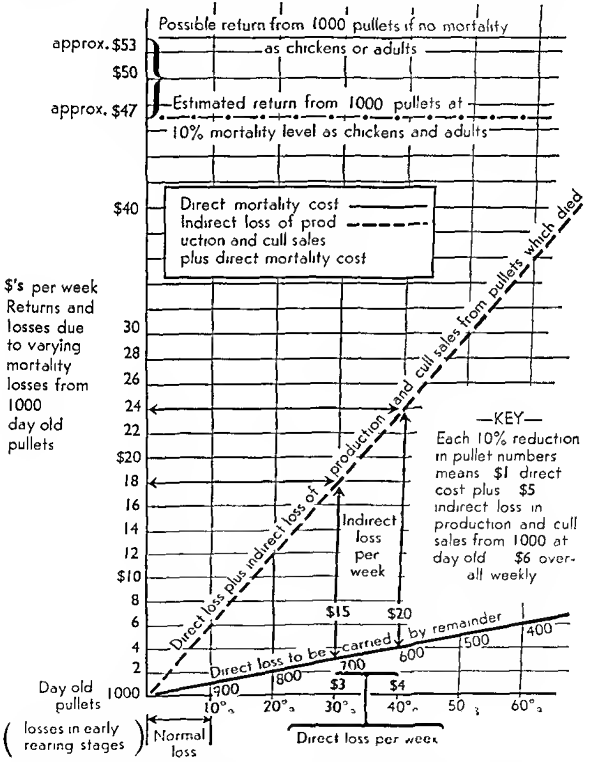


Fig. 46. Graph of mortality with 1000 day-old pullets and the effect upon costs and returns on a 100 per cent pullet farm (using costs as in *Fig. 45*).

5 Fowl-pox at approximately twelve weeks of age, caused by poor husbandry and neglecting to vaccinate

Surviving pullorum affected chickens (from flocks with a high incidence of reactors) will not lay as well when reared as those from clean stock Chickens badly affected with coccidiosis will not attain normal body-size or give top production, though slight outbreaks quickly controlled do not appear to have any marked effect Worm control must be efficiently carried out in order to avoid having a high percentage of culls When pullets catch cold at laying stage, it will seriously reduce the output of eggs Fowl pox can cause heavy economic loss if not controlled by vaccination and good husbandry

These points have been emphasized because they are the cause of many failures in poultry keeping ventures the setbacks and liabilities incurred through them cannot be overcome even by good husbandry when the surviving pullets are handled as layers Preventive measures such as those suggested are imperative if the poultry farmer wishes to have stock in the laying pens capable of good performance, and at the same time to have the lowest possible mortality

From the commercial viewpoint a mortality through all stages of 20 per cent (or double the normal mortality) could mean, if more stock is not obtainable or out of season late hatched stock has to be used, that with 800 pullets raised instead of approximately 900 there will be a loss of approximately $12 per week for the year on the basis of prices quoted under the pullet farm (p 99) (mortality debit $2 and loss of profit from the 200 dead pullets $10) If this is carried further on the basis of 40 per cent loss (as with pullorum, for example), a total debit of up to $24 per week over the full year could be incurred The normal 10 per cent loss would be approximately $1 direct and $5 indirect loss, that is, $6 per week overall These examples emphasize the need for correct brooding and preventive husbandry

ADULT MORTALITY

An example of the economic effect of adult mortality is given hereunder Feed is not taken into account because the birds would probably be laying until near the mortality period, and it is normal for losses to be spread over the year Approximately half a year is lost with each death

100 birds in a pen 1st April
10 birds lost for year (normal)
cull value @ 60c each = $6 lost

Plus loss of half a year s margin of profit per bird = 10 x 80c = $8 lost

Therefore *10% mortality* = $14 per 100 loss
This means for a 1000-bird unit a loss of $140 per year or approximately $2 70 per week

If an outbreak of disease occurs—such as tick fever, which could increase mortality to 40 per cent—the profit margin for the year may be wiped out, reducing the farm return to below subsistence level In this case, on the above suggested basis of 60c for culls and $1 60 profit per bird

per year, a 40 per cent mortality loss per 1000 birds could mean a loss of 400 culls at 60c. each (i.e. $240), and 400 birds at 80c. loss for half a year's profit (i.e. $320), a total of $560, or approximately $11 per week reduction in returns. In an extreme case—such as 40 per cent mortality in adult birds combined with 40 per cent in chickens—this could mean that if the 600 pullets left at the end of the rearing period in turn suffered 40 per cent adult mortality, a farm would be labouring under a total debit of approximately $11 per week direct, and $30 direct plus indirect losses per week. The returns being below subsistence level, the farm would obviously be a losing proposition, with fewer than 400 birds left at the close of the year for each thousand birds started. On the costs given as an example under the all-pullet farm (see p. 99), a net return of less than $1000 for the year could be the result. These variations for adult mortality, on a similar costing basis, are shown on the accompanying graph.

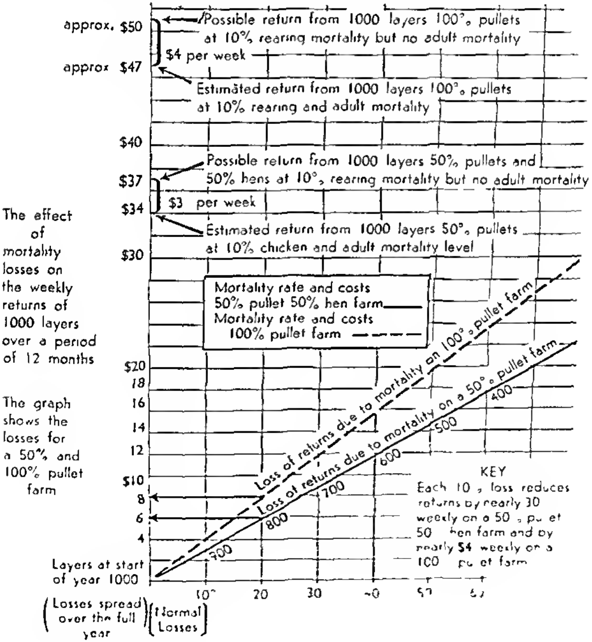


Fig. 47. Graph showing the effects of mortality with layers (costs based on *Fig. 45* and Table 6).

It can be seen that the question of mortality is a very big factor in the success or failure of a farm Mortality rates of 25 to 30 per cent appear to be regarded by some as a matter that is not of extreme importance if the remainder of the birds are laying well, but a farm suffers under a heavy handicap if sheds and plant are not fully used as intended when built The direct economic loss is very considerable, too, as shown on the graph Excessive adult mortality is costing the poultry industry a great deal of money Some poultry keepers have claimed that they have no mortality among their stock, but this is not possible, for records show that even in random sample tests, where birds are given the best of conditions, mortality will occur The annual mortality in prominent official tests of this nature has been between 5 to 10 per cent or a little over Management surveys have indicated rearing losses ranging from 6 per cent to 32 per cent, and adult mortality from 8 per cent to 30 per cent in Victoria and New South Wales

The point that must be emphasized is that environment plays the major part in these results Husbandry and disease control have a dominant effect on mortality levels Breeding plays a less important role Using the right methods as set out for chickens and adults is vital to getting high returns by having low mortality

TABLE 7

PROBABLE LAYING PERIODS

(WL = White Leghorns, AO = Australorps, CB = Crossbreds)

Hatching month and breed concerned		*Probable period to laying (months)*	*Probable start of laying*	*Probable periods of laying before annual moulting period*
July*	WL	5-5½	Dec	2-3 mths, usually 2 mths break, 9 mths
	AO	5½-6	Jan	2 mths, possible 2 mths break, 9-10 mths
	CB	5 6	Dec -Jan	2-3 mths, possible 2 mths break, 9-10 mths
Aug *	WL	5½-6	Jan	2-3 mths, possible break, 9-10 mths
	AO	6	Feb	12 mth laying period
	CB	5½-6	Jan -Feb	12 mth laying period
Sept *	WL	5½ 6	Feb -March	12 mth laying period
	AO	6	March-April	12 mth laying period
	CB	6	March-April	12 mth laying period
Oct	WL	6-6½	April-May	11-12 mth laying period
	AO	6-7	May-June	10-12 mth laying period
	CB	6-7	May-June	10-12 mth laying period

* Australorps and crossbreds hatched in July White Leghorns, Australorps, and crossbreds in August and September, and White Leghorns and crossbreds in September—these will all usually lay through the April to July winter period (normally the highest price level period of the year in Australia) Spring hatching months are shown as the best months, and they also give the longest period of unbroken production

TABLE 7—*Continued*

PROBABLE LAYING PERIODS

(WL = White Leghorns; AO = Australorps; CB = Crossbreds)

Hatching month and breed concerned		*Probable period to laying (months)*	*Probable start of laying*	*Probable periods of laying before annual moulting period*
Nov.	WL	6½-7	June	9-11-mth laying period.
	AO	7-7½	June-July	9-10-mth laying period.
	CB	6½-7½	June-July	9-10-mth laying period.
Dec.	WL	7-7½	July	8-9-mth laying period.
	AO	7½-8	Aug.	8-mth laying period.
	CB	7-7½	July-Aug.	8-mth laying period.
Jan.	WL	6-7	July-Aug.	8-mth laying period.
	AO	7-7½	Aug.	8-mth laying period.
	CB	6-7½	Aug.	8-mth laying period.
Feb.	WL	6-6½	Aug.	7-8-mth laying period.
	AO	6½-7	Aug.-Sept.	7-8-mth laying period.
	CB	6-7	Aug.-Sept.	7-8-mth laying period
March	WL	6-6½	Sept.	7-8-mth laying period.
	AO	6½-7	Sept-Oct.	7-mth laying period.
	CB	6-7	Sept.-Oct.	7-8-mth laying period.
April	WL	6-6½	Oct.	6-7-mth laying period.
	AO	6½-7	Oct.-Nov.	6-7-mth laying period.
	CB	6-7	Oct.-Nov.	6-7-mth laying period.
May	WL	6-6½	Nov.	3-4 mths; moulting period, 8-9 mths.
	AO	6½-7	Nov.-Dec.	2-3 mths, moulting period, 7-8 mths.
	CB	6-7	Nov.-Dec.	2-4 mths, moulting period, 7-9 mths.
June	WL	5½-6	Nov.-Dec.	2-4 mths; moulting period, 8-10 mths.
	AO	6-6½	Dec.-Jan.	2-3 mths, moulting period, 8-9 mths.
	CB	5½-6½	Nov.-Jan.	2-4 mths; moulting period, 8-10 mths.

Table 7 comprises a ready reckoner for hatching and laying periods. The results are based on good husbandry practices for rearing and handling of the pullets. The use of artificial lighting can reduce time for starting lay, and will alter some of the sequences by reducing the moulting periods (see Chapter 17 for discussion of this). Some strains of pullets may commence lay earlier. This table concerns White Leghorns, Australorps, and crossbreds only. For Rhode Island Reds allow two to three weeks more and for Light Sussex three to five weeks more. The crossbreds are White Leghorns and Australorps crossed both ways. (These can be expected, as indicated earlier, to give the highest output per bird.) For comparisons with other crosses refer to pp. 69-70.

SUMMARY

1 Specialization in a particular aspect of the poultry industry is likely to bring about the best returns The purchase of day-old or month-old chickens is the usual method of stocking a plant Well-bred chickens with a background of good laying performance and livability must be purchased *Buy quality pullets—the best that can be obtained, regardless of high prices* It is worth paying 8c extra for each day-old pullet ($7 50 per 100) to avoid the possibility of lower lay and higher mortality

2 The disastrous effect on costs of high mortality among chickens or layers can be seen from the examples and graphs Keep this at a low level by sound husbandry and disease control A strain with reasonably good lay per head and low mortality will give a better net return than one with high lay and high mortality The economic effect of mortality in adult stock, and the loss of eggs, can be checked when comparing figures for hen housed average lay on a farm (obtained by dividing the original number of hens placed in the sheds into the total number of eggs laid for the year) with the monthly average lay (obtained by dividing the number of birds in the pen each month into the monthly total number of eggs laid) A wide margin indicates heavy mortality

3 It is essential to purchase chickens at the right time of the year in order to obtain the best possible rearing, early maturity, and good lay This can be seen from the text discussion and from the ready reckoner Table 7 (A possible variation has been indicated for replacements on cage plants)

4 A high percentage of pullets amongst the stock will ensure a higher lay per bird on the farm The question of good egg size from pullets is one of good rearing practices, combined with correct breeding methods Early egg size is a highly heritable factor Increasing the number of pullets is strongly recommended for maximum efficiency on the poultry unit Examples have been given to illustrate the increased returns possible, due to higher output per layer with 75% to 100% pullet level

Footnote For countries in the northern hemisphere the months shown on Table 7 need to be moved approximately 6 months For example, in India, and adjacent countries, January to February would be favoured hatching months—with a range from September/October to February/March

CHAPTER 8

ACTIVITIES APART FROM EGG PRODUCTION

THERE are various farm activities possible with poultry apart from egg production, and in this chapter we shall discuss the economics of some of them. Average costs are suggested as a basis, and variations in local prices should therefore be kept in mind, as also should the possibility of increased efficiency, both of which factors will alter or improve the scope of such aspects of poultry-farming. The varied activities of a poultry farm apart from egg and meat production may be stated as (*a*) selling stud stock, (*b*) selling fertile eggs to a hatchery, (*c*) running a hatchery, (*d*) custom-hatching operations, (*e*) chicken-sexing, (*f*) selling month-old started stock, (*g*) selling pullets just about to lay, and (*h*) preventive disease control work. Meat production is discussed in Chapter 18.

STUD STOCK SELLING

The sale of stud stock is a specialized activity which previously had some scope. Under changed conditions in Australia today adult stud stock sales have a limited market. Cockerels for breeding purposes are usually sold at day-old stage—and from breeding centres of the large units which combine many operations—to those that multiply stock for them.

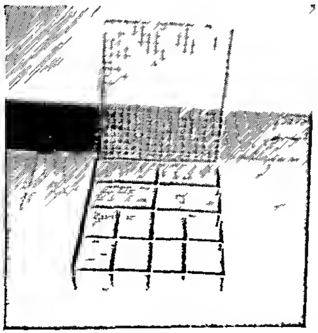


Fig. 48. Pedigree hatching tray, subdivided to allow eggs from individual birds, or pens being progeny tested, to be hatched separately. Chickens can then be toe punched or wing banded as taken from the tray. The usual method of identifying eggs is to pencil numbers on them.

(There may be some field for specialist operators who deal with show-type birds, etc.) The sale of adult birds, however, may have considerable scope in developing areas, either through Government farm centres or from private operators. These centres or operators would be expected to use methods as indicated in Chapters 5 and 6, also in Appendix 7.

Stock must have a sound genetic background, or results will be inefficient. Many pullets have to be tested to prove the value of breeding males. The expense and the amount of work involved in proving a strain in the eyes of the whole poultry industry under open competition conditions is considerable: and not only is careful breeding needed, but careful recording.

Selection of breeding males for appearance calls for checking many points which may not have a marked effect on egg production of the progeny, and on this basis the most that can be expected will be a final selection of possibly one male in every four day-old cockerels hatched. This increases costs, apart from the breeding work prior to this stage. A price with a "meat value only" basis is out of proportion to the value of the bird, and stud breeding should be considered only when the return gives *at least* four or five times the normal meat value of a male bird.

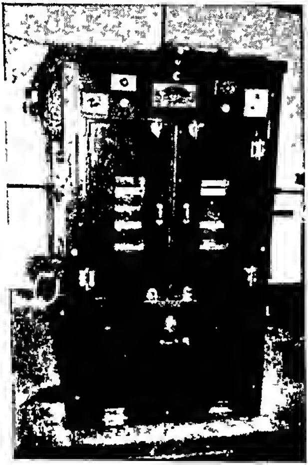


Fig. 49. This type of incubator is of sufficient size to enable a family breeding programme to be carried out on a unit, plus a reasonable volume of day-old chicken sales also. See Chapter 9 and Appendix 6 for further data on this type of machine, particularly for developing areas.

The stud breeder takes a pride in his work and derives great satisfaction from the production of well-bred birds whose progeny will carry the characteristics of high egg production or economical meat conversion This work cannot be assessed on the basis of routine operations

Clubs and associations established for the betterment of the different breeds of birds have helped greatly with this work, which can be described as the backbone of the poultry industry A poultry-farmer who makes a success of breeding, proving his ability under open conditions—i e by means of laying tests such as random tests—may develop a remunerative field of operation in selling stud stock of varying ages and sex, though the financial return from such operations is difficult to assess accurately, since much depends on the breeder himself and on the connections he makes (The comments refer to the normal breeder—the operation of large scale breeding establishments with specialized personnel is not within the scope of a general text book)

SALE OF FERTILE EGGS

A poultryman with a good farm can supplement his income by selling fertile eggs to a hatchery He need not install extra plant, because the ordinary laying-sheds can be used for the mating of the birds, and the eggs are graded and packed in the usual way except that a higher minimum weight is required than may be needed for market—for instance 2 oz instead of $1\frac{3}{4}$ oz or $1\frac{7}{8}$ oz, depending on the grade demanded (28 4 grammes = 1 oz) The following estimates are a guide to the likely returns and to the problems that may arise

Mature hens or well-grown pullets can be used for producing the fertile eggs that are to be sold for the hatching Pullets should be checked for rate of lay and egg-size by part time recording of lay and check weighing of eggs prior to mating Refer to Chapter 6

In the case of birds housed for mating, approximately 10 per cent of the shed space is occupied by male birds, which results in a reduction in the number of eggs produced per shed, allowing that the birds lay nearly as many eggs when mated If possible, make a practice of raising cockerels for mating purposes on the farm from day old stage—many poultry-farmers have brought cockerels to a farm and found that they had some disease or other Respiratory disorders seem to be the most common in these cases If adult cockerels have to be brought in, segregate them from the rest of the farm at a good distance for a few weeks, so that any troubles that may be dormant in them will not flare up when the birds are put into the pens

The best period for supplying fertile eggs is the spring season—stock will be produced that will have the best conditions for rearing, and potential for the maximum laying period Time of supply is a matter for negotiation with the hatchery, though it is suggested that reference be made to pp 93-4, where pullet-hatching periods are discussed

A suggested basis for estimating the prices to be applied to fertile eggs will be given This will be fairly close to the current rates, and adjustment can easily be made for any variation in the price of eggs, either those for

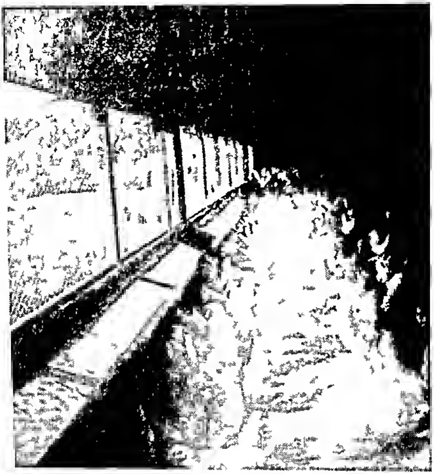


Fig 50 Flock-mated pen of 350 White Leghorns in a large intensive shed for supplying eggs to a hatchery A high standard of female breeders should be maintained, and males should be from tested lines to provide good replacement stock for commercial units

market or those for fertiles The basis covers the normal springtime supply of eggs, and any extension beyond this season is a matter for discussion between the supplier and the hatchery owner Crossbreds are usually produced from matings of two different pure breeds, but can be produced also from pure bred males mated to crossbred females (see p 70)

To give an example of the profit that could be made by selling fertile eggs in spring let us consider eggs at 33c per dozen net (after all deductions concerned with the marketing of eggs have been made) Four hundred breeding hens each producing 3 dozen eggs suitable for incubation after grading and rejections would lay 1200 dozen eggs suitable for the hatchery, during the four months of the spring season At market rates of 33c, value of eggs would be approximately $400 A debit has to be made for the cockerels, and this can be assessed on the basis of one cockerel for twelve hens, which means a production of 36 dozen eggs on this basis, and the cost of the cockerel is spread over these To raise a cockerel on the farm and feed it to the age of thirteen or fourteen months to permit mating for one season would cost, on the basis of feed costs only, approximately $2 20, less possibly $1 when sold if for meat only = $1 20 cost on 36 dozen eggs (If $30 per 100 was paid for stud day-old cockerels it would add 30c per cockerel—in some cases day-old cockerels are sent by the hatchery

to the supplier of fertile eggs for the next season, at a nominal price) This means that at least 3c to 4c per dozen be allowed for mating costs and 7c per dozen for loss of space for some of the laying hens and reduced lay in the sheds This represents a minimum debit of ten cents per dozen If higher feeding costs for males apply, costs increase in proportion

For ordinary fertile eggs from reasonably well-bred stock S4 50 to S5 per hundred may be received This represents approximately 60c per dozen less the 10c debit as above, i e 50c per dozen net At this price the 1200 dozen eggs referred to would give a gross return of S600 The net margin for this period of supply from approximately 400 breeding hens, as compared with market eggs on the basis quoted, would be S200 over the four-month period (Variation in price for eggs may be made according to the percentage hatching obtained)

This example will serve as a guide to the economics of the supply of fertile eggs, and any variations in prices or in the laying period or the quantities laid can easily be taken into account

THE HATCHERY AS A BUSINESS

Specialization is needed in the production of day-old chickens To raise these chicks on a small farm where stud breeding is not the main business can involve a poultry-farmer in a great deal of additional work over a long period handling small lots of chickens Attending a small incubator takes time, as for a large machine, and insufficient time is left for other operations of the farm, thus reducing the overall returns If he can purchase chickens from a reliable source near the time he requires them, and in one or two lots only, it will be worth his while, for he will be able to cut down the long hours of work usual during the breeding season Working too hard and for too long each day is inevitable if a poultry-farmer tries to carry out all operations—and the general efficiency of the farm will suffer

For establishment of a hatchery more is required than just a room and a machine Incubators to hold approximately 40,000 eggs would have to be housed in a building—usually one with a gable roof—measuring 50 to 60 feet in length and 18 feet in width, and 9 to 10 feet to the ceiling A room 30 to 35 feet by 18 feet would be needed for the incubators, which would also provide sufficient space for loading and setting racks, and for some necessary benches A second room 20 to 25 feet long and 18 feet wide would be needed for the holding and sexing of the chickens and for dispatching and other operations

The cost of these rooms, occupying nearly 1100 square feet, might be S4000, for the type of construction resembles that of a home Incubators for 40,000 eggs would cost about S4000 and sundry equipment for benches, electrical installation, water-supply installation, and office equipment would cost about S1000 A total investment cost of approximately S9000 would be needed for a 40,000 egg hatchery This is exclusive of land, which would have to be of building block size These are minimum costs—allowance for unforeseen and reserve should be made

Expansion of the hatchery would mean investment on a nearly comparable basis in relation to egg capacity

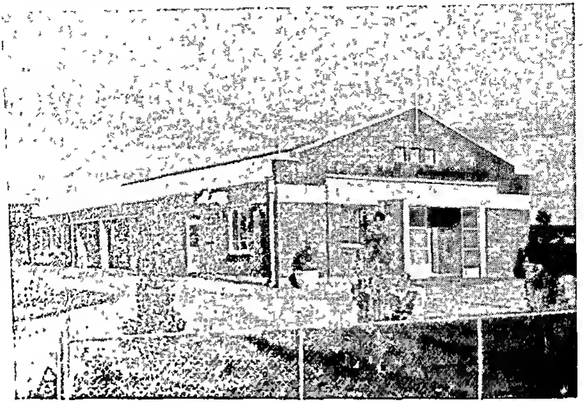


Fig. 51. Outside view of a large hatchery in South Australia with well-appointed surroundings. Large hatcheries show the advance of specialization in the production of chickens.

The following example shows current expenses for each 100 pullets sold, full season average for light and heavy breeds:

Allowance of 350 eggs per 100 pullets: 350 eggs at approx. \$5 per 100	\$17.50
Hatching costs at approx. \$1.25 per 100, including power, replacements, plus depreciation on plant, and interest ..	4.40
Sexing of approx. 230 chickens at \$1 per 100	2.60
Overhead expenses covering advertising, clerical, telephone, sanitation costs, transport to rail or depot are assessed at at least 10% of general expenses	2.50
Average 50-50 light and heavy breeds ..	\$27.00

This example indicates that only a small margin for the owner or operator would be obtained if the price for White Leghorn and heavy-breed chickens were \$28. The margin is dependent upon the price for hatching eggs, and on the hatching percentage. If 300 eggs gave 100 pullets for sale, then \$3 extra is saved per 100 pullets for fewer eggs needed and 50 fewer to incubate. The above figure would give a profit of \$4 per 100 pullets. The sale of cockerels is another matter that can affect the labour and profit margin. If these can be sold, then the value of just over 100 cockerels can be added, but it is doubtful whether light-breed cockerels would be easy to sell. Sales of heavy-breed cockerels can be regarded as possible over a considerable part of the season, which compensates for

the lower hatchability of heavy breeds as compared with light breeds Sales of crossbred cockerels should be a sound proposition A 40 000 egg hatchery would need five full runs a season or year, plus a good percentage of cockerel sales, to show a living basis for the owner operator on the figures given as examples above

It may be asked whether 350 or 300 eggs are too many for producing 100 pullets at day-old stage In general practice, and allowing for the full season and for heavy and light breeds, these numbers are reasonable The following will explain the point

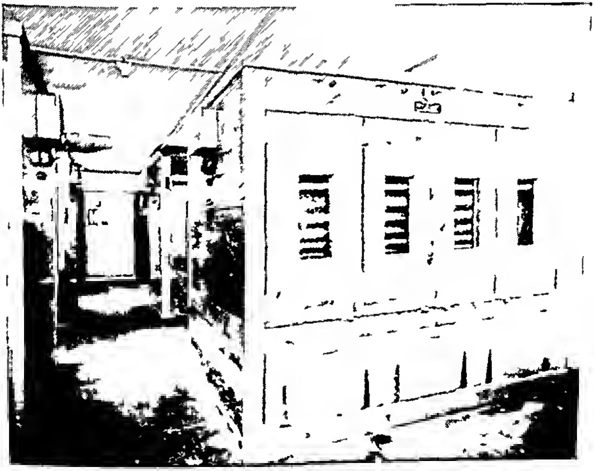
350 eggs set

70 eggs taken out in first fertility test as "clears" Allowing average of up to 15 per cent White Leghorns and up to 25 per cent heavy breeds (and including eggs lost through cracks in transit)

280 eggs left

15 eggs second test (3 to 4 per cent all breeds)

265 eggs left



An average of 90 per cent hatching gives approximately 240 chickens; normal rejection for chickens below standard would be 10 to 15, leaving 225 to 230 chickens for sexing

Normal sexing percentages over a season range around 48 per cent pullets and 52 per cent cockerels, which gives 107 to 108 pullets—nearly the figure of 100 pullets, without allowing for other possible eventualities On the basis of 300 eggs, therefore, slightly better fertility and hatching would be needed to break even with 100 to 102 pullets, so as to allow for extras usually given If sales are made as mixed chickens, all expenses are the same except for the payments of chicken sexing fees This reduces the costs to $24 40 for approximately 220 chickens, equivalent to $11 per 100 $15 per 100 would give a reasonable margin on sale In the case of meat line chickens, when sales are made on this basis of mixed sex prices a similar margin could exist, varied according to the hatching percentage obtained from the eggs set

In view of the above it is suggested that chickens be bought from a hatchery Remember that for greater efficiency specialization is desirable The hatchery can only continue to operate as such when linked to suppliers of good eggs that will hatch well Whatever side of the poultry industry is taken up, it must be done on a large enough scale to make it pay Finally, it is stressed again that it is sound policy to pay a premium for quality chickens

CUSTOM-HATCHING OPERATIONS

In custom-hatching operations the same basis is used as for the hatchery section (see p 110) Where a charge of $2 per 100 eggs is suggested as a figure upon which to work, then a possible margin of 75c per 100 eggs would exist over costs, so that it would be necessary to handle a large number of eggs during the year to make a living To clear $1600 in a year a turnover exceeding 200,000 eggs annually would be required Any movement up or down in the operating costs will of course affect the returns—e g to run a large machine with part loadings would not be an economic proposition

CHICKEN-SEXING

The requirements of chicken-sexing are listed in Chapter 9, where examination standards and general conditions are discussed. The returns are governed by the concentrations of hatcheries in a given area in relation to transport arrangements possible and the speed of the operator. The season is usually for some months of the year only, and the hours are long The rates paid have varied from 75c to $1 50 per 100 chickens plus various arrangements for transport costs An aptitude for the work is necessary. Chicken sexing is a profitable operation for an efficient person with good connections

SELLING MONTH-OLD STARTED STOCK

Under this heading the economics of the business of rearing and selling month-old chickens will be discussed

The sale of chickens at month-old stage has assumed very large proportions throughout Australia The initial business of hatcheries was the sale of day-old chickens, and selling at month-old stage was not done to any great extent It was soon realized that a large proportion of people conducting poultry sideline units did not wish to handle either incubation or chickens in the early brooding stage They felt that it took up too much time and labour and interfered with the operations of a general farm

Nowadays the majority of hatcheries have extended their sphere of operations to include a large brooding plant Mammoth battery-brooder plants holding up to 10,000 chickens in one brooder have been built, some hatcheries use large numbers of individual battery units, each holding 500 chickens Month-old trade is also useful for those occasions when inconsiderate purchasers cancel at short notice, or when transport arrangements are upset, for the chickens can be placed in the brooder and disposed of later, at the month-old stage The methods of handling the chickens are covered in Chapter 10 It is stressed that isolation practice be used in the rearing of month-old chickens, as a safeguard against the spread of disease

Plant needed for the rearing for sale of month-old chickens consists basically of a brooder with suitable accommodation for it On a small plant this may take the form of an insulated shed On a big plant where many thousands of chickens are to be handled, brooders may be in a large building of solid construction

For 1000 chickens brooding equipment would cost approximately \$60 if of the infra-red type and would possibly go as high as \$350 if in battery brooder floors Battery-brooder units are better for handling lots of 100 chickens, for each floor usually accommodates this number The infra-red system would probably operate well as three units for 1000 chickens

The shedding required for infra-red (or colony hover brooders) is approximately 500 square feet for 1000 chickens, with a possible cost for materials only of \$250—making a total of about \$300 to \$320 This cost of materials is based on that suggested for the farms in Chapter 3

For battery brooding equipment 300 square feet of shedding should be more than sufficient for 1000 chickens, and the materials for this would cost about \$150, making a total cost of \$500 These costs would be increased by as much as \$200 if building were done by contract

A general idea has been given of the cost of plant and building With feed at 3c per pound the rearing cost of the chickens to month-old stage would be approximately 8c plus 5c to cover the cost of power or fuel for running the brooder, plus a mortality allowance of 5c (this is with a rearing loss of only 15 per cent—if 25 per cent of the chickens were lost this mortality allowance could be 8c or more per chicken reared, according to the stage at which the chickens died) A figure of 1½c to 2c per chicken would also be a reasonable allowance for interest and depreciation for capital and plant This means a total cost of approximately 19c per chicken—or 20c in round figures The normal price for month old chickens is approximately 30c above the day-old cost, so from the point of view of the seller the figure of 10c per chicken is a satisfactory return, if mortality

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is kept to a reasonable level. The costs worked out for 1000 chickens can be used to calculate the financial return per season for any number of chickens For the purchaser of month-old chickens the price is not exorbitant—for well-reared chickens.

Fig 53 Battery brooders with a capacity of 2500 month-old chickens Chickens reared on good rations and under correct temperature and ventilation conditions can be raised to one month in these brooders without provision of further heating Note ample light provided by windows and artificially For the next stage a warm corner in a suitable shed should be provided

Because of the flourishing trade in month-old chickens, chicken-rearing standards have been improved For instance, pullorum testing has become almost universal, thus saving heavy mortality in early brooding stages Suppliers of stock realize that they must raise chickens that will rear well—for if mortality rose above 30 per cent the margin of profit would be practically wiped out. For the purchaser, weaning arrangements *must* be given for the next stage (see pp. 183-93)

SELLING PULLETS JUST ABOUT TO LAY

The sale of pullets that are just about to lay is another aspect of the poultry industry that could become a specialized department. The combined rearing and selling of pullets just about to lay is a further stage in specialization—and it has now developed to a considerable extent

Advancement in egg-production practices is bringing about an increase

in the number of operators on intensive and battery system units, both of which systems specialize in egg production, but the rearing is carried out in the usual way The practice of selling pullets just about to lay can be an economic proposition for one who specializes in the rearing of pullets only, and if he keeps his prices reasonable the purchaser will benefit too This practice has opened up a promising field to householders and to many sideline producers as well as to specialized egg producers, particularly if they want to handle layers on the basis of pullet production only This type of sale also holds the possibility of a break from poultry farming routine When lighting or small-pen units are introduced, giving an increased winter production, the economics of obtaining only eleven months' lay from pullets can be quite sound, and a break of about three weeks is possible before new purchased pullets are placed in the pen (In some cases, seven to nine months lay can pay)

The pullets should be raised in correct conditions, which include plenty of space, in other words avoid overcrowding, it should also be standard practice to raise them from blood tested stock, and to have them dewormed at the right time, and also vaccinated against fowl pox When pullets are being sold to areas where tick fever may occur, vaccination against tick fever is a good idea They may be reared on range or intensively Chapter 11 goes into the details of rearing methods

Fig 54 Flock of various breeds of pullets being range reared for sale at near laying stage Some buyers of stock—both commercial and sideline—prefer to purchase pullets at laying stage and specialize in egg production only

The cost of raising pullets to laying stage is for feed and equipment plus a reasonable margin for labour Figures are given for the raising of 2000 pullets on open range conditions There will be local variations in the price of land, but I have allowed $500 for the purposes of the following example The plan can be taken from Farm B rearing yards (see p 48), merely trebling the area shown there so as to allow for 2000 pullets Twenty rearing sheds are needed because the rearing will need to be

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in large lots or $2 in small lots—50c to 85c per head, or a possible average of 75c A reasonable return could result for one operator for each 2000 pullets raised, and only six to nine months' work (according to the period of supply of month old chickens) would be involved More birds can be handled by the poultry farmer when no labour has to be diverted to the raising of the stock, which makes up for the extra outlay of 60c to 70c With the spread of the practice of raising stock to laying stage for selling, finer margins are resulting

Because of the variation of costs for the stage between month old and laying, a suggested allowance is required that will give a proportionate labour return and cover feed costs according to normal feed consumption at each stage The allowance suggested for average light and heavy breeds (with *discounts* made for large numbers) is

6 weeks old	approx	70c each
8 weeks old	,,	80c ,,
12 weeks old	,,	$1 each
16 weeks old	,,	$1 25 each
20 weeks old	,,	$1 55 ,,
24 weeks old	,,	$1 65 ,,

PREVENTIVE DISEASE CONTROL

Preventive disease control is carried out by a qualified vet and includes blood testing for pullorum disease, deworming of poultry of all ages, vaccination for fowl pox, vaccination for tick fever, and vaccination against infectious laryngo tracheitis These measures are all preventive of course—I am not referring here to control of disease once it has broken out

The remuneration depends on the efficiency of the procedures adopted, and the number of birds that can be treated daily, also the distances that have to be travelled There is, in addition, the question of competition—naturally if there is one or more other veterinarians the work will be shared, or obtained by the best man This is a remunerative field for a qualified man in the right locality Information on this subject will be found in T G Hungerford's *Diseases of Poultry*

The use of preventive practices such as these is strongly recommended to the poultryman, for heavy economic loss can be averted For example, a 40 per cent loss from pullorum amongst chickens in the first month or six weeks of their life could mean a debit of 25c to be made up on each surviving pullet, plus the loss of the return from over 300 pullets that did not materialize if 1000 were being raised originally—i e on the basis of the figures discussed, $10 or $12 per week Losses due to fowl-pox which could cause a reduction of 50 per cent or more in pullet winter production, could possibly amount to between $1000 and $1200, for up to 2500 dozen eggs could be lost from 1000 pullets in the four winter months

Worm infestation of pullets can bring about similar losses owing not only to delay in commencing production but to the loss of a great number of birds Tick fever can cause heavy mortality, possibly exceeding 50 to 75 per cent (see graph p 101), vaccination is therefore a cheap safeguard

carried out with spring-hatched stock and the sheds and land would not be clear in time to stock them with a second lot of birds If the stock is raised in an intensive unit the investment could possibly be 50 per cent greater—i e $2400, after allowing for the saving on the land Sheds with deep litter can be used for successive lots, by using fresh litter Expansion of operations thus would not necessitate more sheds Expansion of range rearing operations means that more land will be needed, but if sheds are portable no additional ones will be required See also comments on p 55

Items	*Materials needed*	*Approx cost*
3 to 5 acres of land (estimated)		$500
20 rearing sheds complete with sleeping box used in early stage for 5 or 6 sheds only based on 600 pullets coming in every three weeks	*450 sq yds (approx 50c per sq yd)*	240
	2000 super ft timber at $10, inc 300 super ft hardwood	200
3″ x 3″ yard posts (8″ long)	1800 super ft at approx $12 per 100 super ft	220
Netting (sufficient for single yards—only half needed if one enclosure)	1600 yds of 72″ x 2″ (approx 20c per yd)	320
Piping for water	Approx 1000 ft	100
Incidentals		120
		$1700

The cost of raising the pullets is as follows (Mortality for this stage should not be very great, and only a 5 per cent debit has been allowed)

Bringing to month old stage (assessed at day old cost plus 30c) approx	60c
Feed from month old stage to 6 months of age, ample allowance of approx 20 lb at 2c per lb	50c
Mortality debit 5%, plus debit for cost of vaccination and deworming	15c
	$1 25

The above figure is worked out for pullets raised from month old to laying stage—if the operator raises the bird from day old stage then he would reduce his costs by approximately ten cents, for he carries out this work instead of paying another operator (Additional costs as set out for 'Selling Month old Started Stock' must then be allowed) The allowance for labour would be—if pullets were sold at $1 75 per head

CHAPTER 9

INCUBATION PRACTICE

SUCCESSFUL incubation of chickens is essential for the rearing of good stock: there is an old saying, which is very true, that a chicken well hatched is half reared. Incubation is a delicate process, demanding a knowledge of the requirements at each stage

Artificial incubation is sometimes thought of as a comparatively modern practice, but three thousand years ago in China and Egypt large hatcheries holding up to ninety thousand eggs were operating, and similar types of hatcheries are in use today in Egypt The results are good, exceeding 60 per cent of eggs set—in fact, the system of payment for custom-hatching in Egypt is stated to be two chickens delivered for three eggs set, and all available over this for the hatching fees The method is to warm the internal chamber or room by means of a fire or a charcoal burner, maintaining the temperature by adjusting the fire or opening up flues—depending on whether the room feels too hot or not hot enough Eggs are turned in the racks by hand. The practice as a whole is an example of incubation as an art rather than as a science

Many experiments were made during the evolution of the modern incubator Two of the most important inventions were (*a*) the capsule for automatic regulation of an incubator, patented by Hearson in England in 1881, and (*b*) the first American large-scale incubator, made by Cypher *in 1895 In 1922 Petersime of the United States produced the first American* all-electric incubator "Modern" electric incubation therefore dates back to the last century It has been an important factor in the progress of the poultry industry, particularly over the past thirty years

The earlier machines allowed for setting and hatching in the one compartment This is still maintained in many cases, with good results, but more efficient ventilation, control of moisture, disinfection, and better average results will be obtained by having a separate compartment for the eggs to hatch in once they have incubated for the first eighteen days

Improvements to the machines were made from time to time in regard to regulators, ventilation, moisture control, and testing, and incubation practices were revised and brought up to date periodically The modern electric incubator can be operated on a set schedule, with no element of guesswork. Given good breeding stock and fertile eggs, efficient operators of incubators can plan a programme for a season and can, with a reasonable degree of accuracy, "count their chickens before they are hatched"

In nearly all hatcheries in Australia the large cabinet electric machine is installed It does not take up very much space—a kerosene-operated incubator of similar capacity would require a room three or four times as large Egg-trays are all on one level in the latter type, whereas in the electric cabinet type the eggs are placed in tiers within the compartment An even

for areas where this trouble may exist Similar heavy losses have been known from infectious laryngo-tracheitis Where outbreaks of this trouble have occurred it is a sound precaution to vaccinate as a general practice

SUMMARY

1 Various avenues of the poultry industry can be specialized in These include sale of stud stock, sales of eggs to a hatchery for chicken sales or custom hatching, selling of young stock at month old or near laying stage, and preventive disease control work All of them depend on the efficiency of egg production as a business

2 Returns from any of the branches described will be decided by the preference of the operator for the work and by the efficiency of methods employed The basis for capital investment needed, and possible returns, will serve as a guide for assessing the possibilities of each branch

3 Before taking up a particular aspect of poultry farming or allied activities assess possibilities in the locality you are interested in

4 An extension of specialization in some aspects of the poultry industry will result in improvement of overall efficiency in poultry production (Specialization in meat production aspects only is covered in Chapter *18*)

the refuse from the hatchery There should be well-designed signs, a good road- or drive-way, parking facilities, and a setting of lawns and shrubs if possible, for there is no doubt that a hatchery with a pleasing approach is an asset

HYGIENE AND SANITATION

Hygiene and sanitation in a hatchery must be regarded as a very important matter, not only for the welfare of the chickens but for that of the hatchery owner and his staff and the purchaser The sexing-room must be kept very clean, chicken sexers should wear clean coats and take care to wash their hands before starting work Chicken boxes should be used only for outward transport of chickens—they must not be returned to the hatchery All trays and tables must be disinfected between hatches, and machines and all rooms in the hatchery cleaned and disinfected regularly Vermin must be controlled—this is most important, for rats and mice could undo all the good work that has been put into cleaning and disinfecting and other hygienic practices

Even in the cleanest hatchery pullorum disease may take a hold, for it has nothing to do with conditions there, but is passed from the hen to the chickens before they are hatched (i e inside the egg) Blood tests for breeding birds are therefore essential—in fact it is one of the basic necessities in hatchery operations today

SUPPLY OF EGGS TO THE HATCHERY

Well established poultry-farms are the usual source of supply of eggs to hatcheries They specialize in this, and it is a good practice to do so, as I have said before, specialization in a particular branch of the industry will result in improved efficiency In this case both parties must be aware of the necessity for maintaining a high standard through correct breeding and hatching methods The most efficient hatcheries in Australia have a good reputation as suppliers of stock, and the best guarantee of this is the repeat orders that they receive year after year The percentage of chickens hatched from eggs set in the Australian industry has not been exceeded in any other country

The arrangements made between farms and hatcheries for the supply of eggs are generally fairly flexible, in that certain quantities of fertile eggs are supplied at a premium price on market eggs or at a fixed rate for the season, provided that the eggs are of good quality and of a fixed weight (a minimum of 2 ounces is desirable) The supplier, either on his own behalf or in conjunction with the hatchery, may undertake to mate up male and female lines supplied to him, in an integrated operation He guards against supplying diseased eggs (for example, he makes blood tests of the breeding birds), and he also undertakes to feed the breeding birds correctly The supplier of fertile eggs is between the breeder and the hatchery and is often known as a 'multiplier" (See also pp 107-9)

SEXING OF DAY-OLD CHICKENS

Sexing of day old chickens by qualified specialist operators enables pullets and cockerels to be sold separately or the cockerels destroyed if

temperature can be maintained in all parts of the section by forced draught from fans or beaters. These machines also save a great deal of labour, for ventilation is automatic (no lifting out of trays for airing), and turning is partly or wholly automatic (in some machines eight to ten thousand eggs can be turned by the movement of a lever). It is important that turning be done at regular intervals. In many large incubators all needed operations are carried out by automatic processes.

The normal capacity of a hatching chamber is usually one-third of the setting compartment where hen eggs are being incubated.

Attempts have been made in Australia to adopt the automatically regulated warm-room principle. Conditions inside the room are uncomfortable for the operators (100°F. and 50 to 90 per cent humidity), and the results have not been as good as those obtained with the large cabinet machines. The temperatures of these are easier to control, for they have the additional advantage of air at room temperature surrounding the machine Very large type machines, exceeding 50,000-egg capacity and with provision for walking inside to handle trays, have given very good results. This double insulation helps to secure good hatching results, particularly in very hot or cold weather.

THE LARGE HATCHERY

The large hatchery is big business when capacities of over a hundred thousand eggs are involved, for accommodation must be provided for more than just the incubators—separate rooms are needed for egg receival and for fixed and movable tray storage. Eggs are loaded on racks and these are brought on trolleys to the machines. A separate chicken-sexing room is necessary, maintained at a reasonable temperature level. A chicken-*dispatching room is needed also. It* is advisable to install a destructor for

Fig. 55. A well-known Western Australian hatchery with a capacity exceeding 130,000 eggs.

the cockerel chick having a down somewhat resembling the fur of the ordinary grey rabbit, and in the pullet chick looking much like an emu or game chick with a dark stripe on the back Other crosses have given a feather growth or a colour factor. For example, W L male x R I R female gives pullets with short wing feathers at hatching, while cockerels do not have them. Sexing cost saved is slight (about 1 to 2 cents per chicken) where available, but this is helpful in developing areas

Fig 56 Sexing day old chickens by the vent method In a light of 150 to 200 watts (behind the screen in this case) examination is made for minute eminences inside the vent Chickens here are warmed by heaters and agitator behind the screen Usually they are kept in chicken boxes at room temperature

TRANSPORT OF CHICKENS

The rearing of chickens can be adversely affected if they are not handled correctly after they have been sexed and while they are being transported Standard day-old chicken boxes will give 100 per cent results if other conditions are satisfactory The interior of the car or van used to transport

not required for table purposes (the decision rests on whether the breed concerned is a light or a heavy breed or a crossbred, young light-breed cockerels can be profitably raised for early-stage sales if a suitable market exists) Before the introduction, some twenty years ago, of the method of sexing day-old chickens by examination of the vent, it was necessary to raise chickens to approximately three weeks of age in the case of light breeds, and determine their sex on appearance, and to a later stage in the case of heavy breeds This necessitated provision of more brooder space and also of extra feed, which meant, in many cases, financial loss on the early rearing stages Examinations in chicken sexing were instituted by the Department of Agriculture in New South Wales when the new method of sexing was introduced, and other States followed later

It was the Japanese who brought the vent examination method to Australia Today there are Australian sexers who can sex with over 98 per cent accuracy at a speed of a thousand chickens per hour The examinations for a special certificate conducted by the Departments of Agriculture require three hundred chickens to be sexed in forty five minutes with an accuracy rate of 98 per cent without injury to any chickens For a first-class certificate two hundred chickens must be sexed in thirty minutes with an accuracy rate of 95 per cent, also without injury to any chickens Sexing is not easily learnt, and it demands a great deal of practice (and expense) with many hundreds of chickens To verify the sexing, post mortems are held on the chickens that have been examined by the sexer The work is seasonal, and qualified operators with a good connection usually work long hours during the chicken season A qualified sexer can examine the minute eminences inside the vent without injuring the chickens The greater majority of chickens in the industry today are sexed

A chicken sexing machine has been invented which allows the operator to sex the chickens by examining the ovary or the male organs through a small tube inserted in the vent The tube has a light at one end, and observation is made through the eyepiece—which is somewhat on the lines of a jeweller's eyepiece Tuition is required in the use of this instrument in order to locate the organs accurately, and practice is needed also Some authorities think that slight injury may be done to the chickens, but this depends mainly on the skill of the operator Reports received indicate that sexing by machine is accurate but that the sexer does not reach the speed of a skilled sexer who uses the manual method of vent examination In places where it is difficult to obtain a qualified sexer—owing, for example, to distance from the recognized centres, and speed is not so important—the machine may be more sought after, for the operator does not require quite as much tuition as the manual sexer (Sanitation is important too)

Another method of sex determination—which has been known for many years—is that of sex linkage by the cross mating of two breeds that will produce chickens of a different colour for each sex A common example is the mating of a Rhode Island Red male with Light Sussex hens (gold x silver) In this case, when the chickens are hatched the pullets are red and the cockerels white When this cross is reversed the linkage does not occur The Legbar breed—an auto sexed breed evolved at Cambridge by a combination of Brown Leghorns and Plymouth Rocks—results in

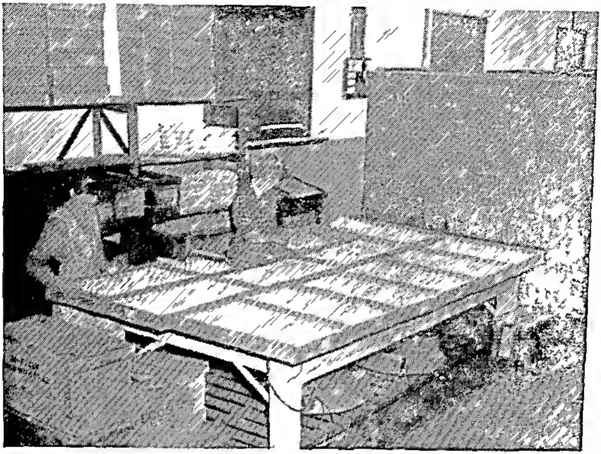

Fig 57 Grading and setting out eggs on incubator trays ready for loading in a big hatchery They should be from blood tested stock of known pedigree

For purposes of hygiene it is necessary to wash dirty eggs with warm clean water When washing the eggs handle them very gently They should be taken clean from the nest Dirty nests cause bacterial contamination in eggs The affected eggs develop as "rots", and may explode in the machine (see Chapter 16) Finally, place them carefully on the setting trays with the broad end up, and keep them out of draughts

Eggs sent to a hatchery for custom-hatching or as fertile eggs for sale should be checked for size—this is the standard practice of all good operators of incubators Reject eggs under 2 ounces in weight and very large eggs, also those with poor shell-texture, eggs with rings showing up should also be rejected, as well as any badly misshapen eggs These precautions will ensure that stock will lay good eggs not small poor ones Poor quality shelled eggs must be eliminated, either for the home market or for export

Pack the eggs carefully, using large fillers and keeping big eggs for the top layer It may sometimes be necessary to alternate large and small eggs in order to get them into the fillers Using pads at the bottom and sides of the case will prevent movement of the fillers Do not nail down a box containing fertile eggs—use screws if the box is not made with a sliding lid

A practice that could be adopted with advantage by many incubator operators is that of testing eggs before they are placed in the machine This will enable spider cracks in the shells to be detected as well as poor

them should be well ventilated, without draughts It is necessary to prevent leakage of exhaust gases into the van Tarpaulins must not be used to cover the boxes nor their sides, nor should boxes be placed against an engine where they will get too bot Keep boxes away from any opening where the wind could blow directly on them during travelling periods In brief—conditions comfortable for human beings

In nearly all cases chickens can be fed upon arrival from the hatchery as soon as they are placed in the brooder Transfer to the brooder should be made under warm conditions—have the room free from cold draughts while the chicks are transferred from their box to the warm section of the brooder

INCUBATION PRACTICE

In operating incubation machines the best rule is to follow the makers' instructions, but the observations made in this chapter should be an additional help with most types of machines Temperature and humidity requirements are usually the same in all makes, from electric incubators of all kinds down to kerosene-heated ones

Correct handling of breeding stock is essential for success in incubation There is a tendency to consider that an incubator should hatch a high percentage of all the eggs in the machine, thus implying that everything depends on the incubation practices employed This is incorrect successful results in incubation can be obtained only if eggs are from healthy, correctly fed stock In the feed there should be sufficient protein, vitamins such as Vitamin A, D_3 and B_2 (riboflavin), and manganese—to mention only a few of the many needed factors Feeding of breeding stock is a very important matter, for heavy losses of potential chickens in the eggs, and *also of chickens hatched in the early stages of rearing, can result from in-*correct feeding rations

If results of incubation have been unsatisfactory it will be necessary to discover whether the fault lies with the incubator or with the stock

Refer to Chapter 6 for discussion of correct breeding practices and to Chapter 14 for guidance on correct feeding rations for breeders

SELECTION OF EGGS FOR SETTING

For best hatching results, setting eggs should not be held longer than one week (except if holding for family testing—have been held up to 14 days to set as one lot to obviate hatching date effect) They must be held under good conditions during that time Low temperatures (such as those in an unlined shed during frosty weather), or excessively high temperatures (as in the same shed late in the season) will result in poor hatches Proper conditions for holding eggs for setting include a room that is free from draughts and in which the temperature does not go below 50°F nor above 70°F , humidity should be between 60 and 70 per cent After the eggs are received at a hatchery twelve to twenty-four hours should elapse before they are set, to allow them to settle down When the eggs are being collected they should be carefully handled. Keys type fillers in baskets are recommended for collection of eggs

if all the trays in a compartment are loaded at the same time, the temperature in the chamber tends to fluctuate unduly as transfer time approaches, making regulation of heat in the different compartments of the machine more difficult The aim should be to achieve a proper spacing of all trays at the same stage of development throughout the machine This is standard practice with many makes of incubators If the trays are placed in each section according to the time of setting, maximum results should be obtained, for the following reasons

1. A similar number of eggs in each compartment at each stage of development helps to keep the temperature even throughout the machine

2 The presence of early-stage eggs between other eggs in an advanced stage of development appears to be beneficial to the early-stage eggs

3. Eggs reach the incubation temperature more rapidly than when a full compartment is set

4 If breaks occur in the power-supply there is less risk of overheating the top trays If trays are loaded together and the eggs on them are at an advanced stage, they may overheat at the top if the current breaks, which means that the trays must be spread out By staggering the times of placing trays in the incubators you will have no hot places, and thus if a break in the power occurs the ventilators in the setting compartment can be almost entirely closed up No harmful results will be experienced as long as the break is of short duration only

5. The spreading out of the tray-placings in this way also helps to overcome temperature variations in the compartment that occur in some makes of incubators

One method of staggering is to fill every third tray in the first loading—i e nos 1, 4, 7, in each compartment The next loading would then be trays 2, 5, 8, in each compartment, and the final loading 3, 6, 9, in each compartment Alternatively, the trays can be loaded on a colour basis, using, for example, red trays first, then blue, followed by yellow trays The colour sequence would run in the same way as the number sequence explained above

Trays are left in the order in which they are loaded until they are ready to be transferred to the hatching chamber, or to hatching trays at the bottom of the machine if setting and incubation are in the one section This system of setting eases the labour of adjusting the machine for various numbers of eggs, and it also prevents overloading If one wishes to incubate more eggs to make up for those taken out on account of low fertility this can be done by adding an extra tray to each loading This tray will be available in the event of the first loading having been reduced when unsatisfactory eggs were removed at the first egg-test (this test can be carried out three or four days after setting, and in some cases after twenty-four to thirty-six hours of incubation) The extra tray would be cleared before it is required again, and thus space would be gained without altering the setting schedule When fertility is high, of course, the machine will carry an almost full load, and there will be no need for the incubation of extra eggs

texture, such eggs can be rejected at this stage, thus saving valuable incubator space (Future practice may involve checking for internal quality as well)

INCUBATOR ROOM

A basic need for the operation of any incubator is a suitable room This should have insulated walls and be well ventilated—ordinary windows and two doors usually suffice Good ventilation in the room is essential because fresh air must be supplied to the inside of the machine (eggs will not batch in a badly ventilated room) The oxygen level of the air should be 20 per cent or over If the room feels comfortable to the operator when he is working in it, this is a sufficient test and results will be satisfactory If it feels at all stuffy the ventilation should be improved Walls can be insulated by an inner lining consisting of board, asbestos, or other suitable material Sufficient room should be provided for working operations (e g for loading-rack and testing facilities), and space must also be allowed in front of the machine to enable trays to be put in and taken out easily Size of the room does not matter provided the ceiling is not too low and there is space for the various operations Chapter 8 gives some suggested room sizes, which vary according to the number of eggs held for setting

HATCHING TIMES

Incubators can be set to hatch once or twice weekly, depending on the arrangements made for chicken-sexing, transport, procuring of eggs, and so on Results may be better if twice-weekly hatching is the rule, for the eggs will be fresher, but many hatcheries obtain excellent results with weekly loadings The results are unsatisfactory when eggs are held very much over 10 to 14 days

Calculation of the setting time calls for special attention When the setting compartment contains a large number of trays it is usual to set only a few of them at a time Loading a small number does not materially affect the temperature of the chamber for very long, the type of heating element used decides this Rapid heat is attained with large heating elements, in such a case, if eggs are set at, say, 7 a m on a Monday, then the chickens should be due three weeks later at 7 a m on a Monday, and could be removed from the machine at about 1 p m that day In some large machines with only small "horseshoe"-type heating elements in each compartment, a greater percentage of the trays in each compartment are usually loaded each time, which means that the hatching will take place later If the chickens are to be hatched at 7 a m on a Monday and taken out at 1 p m the same day, then it would be necessary to place the eggs in the machine between 9 p m and 10 p m on the Sunday evening—i e ten hours beforehand—in order to allow for the lag, the setting time is then calculated from 7 a m on the Monday

POSITION OF TRAYS

The position in which trays are placed in an incubator is important As the chickens grow within the eggs less heat is needed from the incubator,

the eggs are turned, owing to a slight alteration in the circulation, but this is corrected when the eggs are turned to their former position A variation of two degrees or more is enough to affect hatching results to a great extent A low temperature right through (e g 99°F) will result in late hatchings, and a high temperature (e g $100\frac{1}{2}$°F to $101\frac{1}{2}$°F) will result in a high percentage of eggs hatching too early Always check thermometers before the season begins

Because of the forced draught, which should give a uniform heat all around the eggs, electric machines are much more sensitive to temperature variations than the small still-air machines

CURRENT FAILURES

Incubators generally have an alarm system of dry cells with a circuit, similar to the ordinary doorbell or buzzer If the temperature varies more than two degrees either way from the set mark of 100°F a bell rings This could be controlled by movement of the regulator arm when the machine becomes overheated or if it is too cold

The alarm system must be switched on at night before the operator retires As a matter of fact it is safer to keep it switched on all the time—except when the machine has to be opened for loading, testing, or for any adjustments Then there will be no danger resulting from forgetfulness

A break of three or four hours in the current will not unduly affect the incubation process, in fact, in cases where no auxiliary plant is available breaks have been experienced of up to eight hours which have not had a very marked effect on the results when the eggs are in the setting compartment (Running the machine at an average temperature of $100\frac{1}{2}$°F for a week following a break of seven to eight hours will assist in keeping the hatch up to time) When a break of this duration is unavoidable and the staggered loading system referred to is in operation, the ventilators must be nearly closed This will help to keep the eggs as warm as possible Fresh air must be maintained inside the machine, so the ventilators are not closed right up—unless there are only a few eggs being incubated in a large compartment Conditions in the hatching chamber will present a greater problem if a power interruption occurs when chickens are just hatching In this case there is not only the effect of a reduction in temperature, but the need for extra air for chickens that have left the egg (Chickens will quickly protest when they begin to feel the need of air) In a case such as this *open all the ventilators* and, if a fair percentage of chickens are out open the door slightly as well It is also a good idea to try to turn the blade or fan frequently during this period to help the inward flow of fresh air This must be done by hand if necessary

In machines with ample space (i e those in which the trays or central drum occupy only about two thirds of the total inside space) these measures have proved effective in minimizing the adverse effects of breaks in the power-supply In machines whose trays have a different turning action, and in which the space is more completely filled, it may be necessary to open up more than for the other types

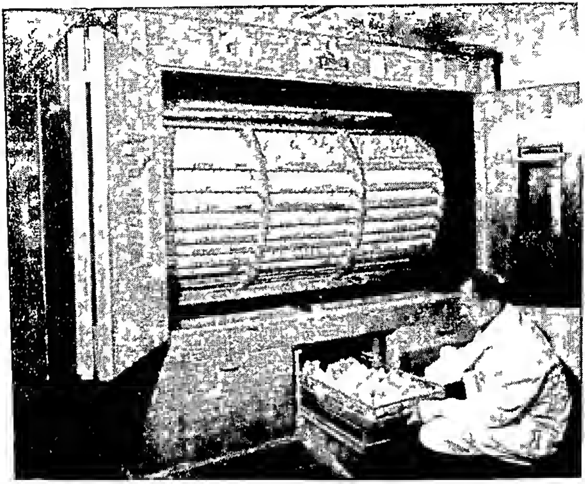

Fig 58 Large electric machine of 16,000 egg capacity, showing the setting trays in the drum Figures to the right of each tray refer to the staggered loading system The other figures indicate the number of trays in each setting, machine identification, and tray position Chickens are shown hatching in the bottom Water-trays provide humidity necessary for incubation

TEMPERATURE FOR FORCED-DRAUGHT MACHINES

The temperature to be maintained during incubation in electric forced-draught machines should be as near as possible to 100°F for hen eggs The temperature may vary from 99¾°F. to 100¼°F but controls must be adjusted so that this variation is not exceeded For good results the maximum variation within the machine must not exceed 99½°F to 100½°F Temperature readings should be taken at more than one place—in fact, in at least three places—in the incubator, in order to see whether temperature varies within the section. Readings should be taken in the middle of the compartment, as well as by the side of the bottom and top trays Efficient capsules, correctly set and lubricated moving parts, and a good mercury tube (i e one with the mercury showing bright, not dull or dirty) or a good micro-switch should ensure a correct cut-in and cut-out, with only a very small movement of the adjusting or setting screw or control Always maintain spares for these vital parts Many machines will cut in or cut out the pilot light with a quarter- to a half-turn of the adjusting screw. In some types of incubators a slight variation in temperature may occur when

material should be sewn around the bulb of the thermometer The end of this material is then placed in a small bottle containing distilled water or rain-water (Refer to Fig 59) Renew the wicking periodically, otherwise it will gradually become hard and will not record accurately Evaporation is fairly rapid in a forced draught machine, so that it will be necessary to refill the bottle every few days Immersing the bottle or filling it with a nozzle type filler—as in topping up car batteries—is helpful The comparison between the two (wet and dry) thermometer readings will give the percentage of humidity

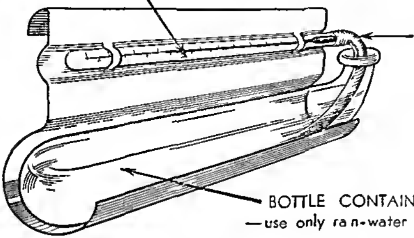

Fig 59 Illustration of a wet bulb thermometer to be used to check incubator humidity

In a machine in which the inlets and outlets have been adjusted correctly and the superficial area in the water tray is also right, the wet bulb thermometer is very sensitive The opening or closing of one ventilator will alter the reading, provided the wick is in good condition, the reading on the thermometer will always be correct If you are using a mechanical indicator, make sure that you check it at intervals with a wet bulb reading

MEASURING HUMIDITY IN SETTING CHAMBER

Humidity should be maintained at between 46 and 52 per cent These are average readings for eggs of heavy and light breeds and for varying seasons When incubating White Leghorn eggs only, a reading of 82°F (46 per cent humidity) is sufficient early in the season (i e when outside conditions are rainy or moist), and up to 83°F later, during fine weather Some operators have reported good results with a reading of 81 F

When eggs of heavy breeds only are being incubated a reading of 83°F (49 per cent humidity) is correct early in the season, and up to 84°F later, during fine weather The reason for this variation is the greater density of heavy breed eggshells When all breeds are incubated together a reading of 82°F early in the season and 83°F during fine weather periods later can be taken as the best guide Adhere as closely as possible to these

TURNING OF EGGS DURING INCUBATION

Regular turning of eggs during incubation is necessary, and if this is done twice daily up to the eighteenth day—once in the morning and once in the evening, and at about the same times each day—very satisfactory results will be obtained, and no further turning will be needed once the eighteenth day has passed Experience has shown that turning eggs twice daily should be sufficient, though some authorities indicate that turning them three to five times daily by means of automatic devices attached to the machine improves results In this case the eggs are, of course, turned to a set schedule automatically Machines that have handles on the outside for turning give good results with a twice daily regular schedule Great care must be taken to handle the turning gently (*This is stressed*)

CONTROL OF HUMIDITY

The control of moisture is a very important feature of incubation work, and for efficient hatching results humidity percentages must be maintained with as much care as temperature in the incubator Some makes of machines require less attention in this regard than others Where circulation of air depends on a fan or beaters, situated behind the trays or turning around a drum, it is easier to control humidity than in machines that have a blade to drive the air through the section This latter type calls for closer attention to humidity readings if the circulation of air is too rapid Rapid circulation should not be maintained, otherwise it will be necessary to have larger water trays than normal, and this is not desirable

A correct combination of temperature and humidity factors is necessary for good hatching results In many hatcheries it has been seen that when the humidity varies to a marked degree (e g high humidity between the third and the eighth days, or low humidity at hatching time) there has been a great reduction in the number of chickens hatched Guesswork must be eliminated from incubation practice The humidity should be measured with a wet-bulb thermometer To make set rules for using a measured quantity of water daily, or to move ventilators a set distance, is not satisfactory, because of the varying weather conditions that will be encountered An insulated room is subject to variations in temperature and humidity according to weather conditions outside Mechanical indicators used have not been found as accurate under all circumstances as a wet bulb thermometer It is advised therefore that the thermometer be used always (Some incubators now incorporate automatic control of humidity)

USE OF WET-BULB THERMOMETER

The wet-bulb thermometer is used to measure the percentage of humidity in the air within the machine For successful incubation it is essential that eggs dry out at the correct rate, and the humidity required to bring this about is approximately 50 per cent during the setting stage Wet-bulb thermometers can be purchased, but a satisfactory one can be made by covering a thermometer bulb with wicking, or with material such as tea-towelling (provided this is not too thick) Three or four inches of the

OPENING OR CLOSING VENTILATORS

Ventilators totalling approximately 3 square inches for both the inlets and outlets usually operate satisfactorily for a compartment of four to five thousand eggs To distinguish between inlets and outlets burn a candle or match near them and see which way the flame is drawn In damp weather, particularly in heavy rainfall areas or early in the season, it may be found that no moisture need be added in the setting chamber the placing of fresh eggs in the machine is sufficient to maintain humidity Humidity is also influenced by the number of incubators in a room—the more machines there are the higher the humidity of the air Incubators in a brick room with a concrete floor are less likely to need water-trays than those in a lined room with a wooden floor In machines having a normal rate of air circulation, trays with a superficial area of 3 square feet will usually maintain the required humidity in fine clear weather for a compartment of approximately six thousand eggs, adjustments to the ventilators are made as necessary Size of the trays varies according to size of the compartment In some incubators with compartments of 4500 eggs there are in each compartment inlets approximately $2\frac{1}{2}$ square inches in area that are fully open, and the outlets are adjusted according to wet-bulb readings In smaller machines the inlet would be reduced accordingly (e g a $1\frac{1}{4}$-square-inch inlet for a 2500-egg compartment)

WATER-TRAYS

The surface area of a tray, and not the depth of water, decides the percentage of humidity Trays may be of various sizes, and a sliding lid will be an advantage, for the size of the exposed surface can be increased or decreased as required—easier than replacing a tray The lid can be made by cutting a piece of galvanized iron about 2 inches wider and 2 inches longer than the tray Turn the edges of this sheet down over the edges of the tray, then cut a small slot about an eighth of an inch wide at the outer ends of the front lip When this lip is placed inside the tray, the cover can be moved along as necessary Alternatively, a tray may be tilted for similar effect Under normal operating conditions in fine weather about 6 inches of an 18-inch-wide tray may be exposed in a 4500 egg compartment

CIRCULATION OF AIR

Some air circulating in the compartment is needed to help maintain humidity, but not too much Do not close up the ventilators completely in order to maintain the reading, unless water-trays are added If it is necessary to open all ventilators to their fullest extent reduce the area of water

HUMIDITY IN FINAL STAGE OF HATCHING

In the last stage of hatching, which has been calculated as being from the eighteenth day onwards for hen eggs, a high percentage of humidity will be needed in order to bring about a good hatch A practice that has been successful is that of inserting a water-tray of approximately 3 square feet superficial area in a compartment to which 1300 to 1400 eggs have

because it is early in the season and only a few eggs have been transferred—the inlets must be reduced further and the outlet can be closed up almost completely until the hatching is nearly finished Late in the season, with full loadings and warm weather, it will be necessary to open up ventilators more at each stage in order to keep the temperature down This also safeguards against overheating and possible loss of chicks in top trays More water trays may have to be added, or the number of drops of water per minute may need to be increased

I must stress once more that when moisture is cut off, ventilators must be opened In warm weather when there is a good hatch it will probably also be necessary to open the doors slightly when the chickens have dried off, in order to keep the temperature down The opinion has been advanced by some oversea research workers that a high percentage of humidity during hatching helps to control disease in the hatching chamber, and observations of the hatching results of various machines indicate that they are right

TIME OF TRANSFER TO HATCHING CHAMBER

Some confusion may exist as to the time when eggs should be transferred to the hatching chamber The eighteenth day, which I mentioned earlier in this chapter, is sometimes miscalculated, and I would suggest that a later transfer than is usual be made Excellent hatches have been observed from transfers made when a few eggs have begun chipping Take an example of eggs loaded on Wednesday evening (these are counted as having been set on Thursday morning) The eggs are not transferred till Monday evening—in some cases not till early on Tuesday morning—and the hatching results are excellent It is not good practice to transfer at what could be regarded as the seventeenth day—it is better to delay till the nineteenth day Eggs must be handled gently Do not keep them longer than necessary out of the machine

HUMIDITY OF HATCHING CHAMBER

The approximate readings on the wet bulb thermometer during the hatching period are as follows

Time	*Dry bulb incubator thermometer reading*	*Wet bulb thermometer (approximate reading)*	*Humidity per cent (approx)*
Late evening of 19th day	100°F	94°F	80
Morning of 20th day	100°F	96°F	86
9 p m to 10 p m 20th day (when moisture removed)	100 F	97 F 98 F	90–3
7 a m 21st day (when chickens due)	100 F	92°F	74

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been transferred Additional controlled moisture can be provided by means of a drip tap a 4- or 5-gallon drum is placed on top of the machine, and a small tap attached to a tube of metal or rubber siphons water from the tank The water drips from the tap into a small funnel, which is set so that the drops fall on the agitator blade If the blade is on the same side as the control for the machine, a metal baffle or guard should be placed under the control to protect it from water The water-level in the tube must be constant, for a constant number of drips per minute must be maintained irrespective of the height of water in the tank The rate of drip should be between 35 and 40 drops per minute With a larger compartment (e g one holding up to 3000 eggs) the rate can be increased to approximately 50 per minute and two water-trays will be needed. (In some larger machines an automatic atomizer spray under constant pressure is used) The length of time during which the drip can be in operation under normal conditions is thirty-three hours, beginning approximately forty-three hours before the chickens are due (thus cutting it off ten hours before they are due) When the drip is stopped (which is when the hatch appears to be completed) the moisture tray can also be removed (open and close the door quickly when doing this) and the ventilators opened up to dry the chickens

If the hatch is coming through slowly (this will be seen with the help of a light or a torch shone through the glass panel in the door), the moisture must be left on for about an hour or so longer Do not disturb chickens that have hatched by shining your torch into the compartment too often, otherwise they will scramble over chickens that are hatching, and some will be injured, the eggs may also be "capped" by broken eggshells For the best results the hatching chamber should be darkened In the absence of a solid outer door hang a cloth over the glass portion of the door, like a window-blind

In some machines that are used for setting and hatching together, a drip tap cannot be used, and the necessary high humidity can be obtained by inserting an extra tray, or trays, of water half-way up the compartment, on top of the hatching trays, and also at the top of the compartment In addition a narrow tray may be fixed in suitable brackets on the side, just below the blade or beater These measures are quite in order as long as the necessary humidity readings are obtained The object is to attain these figures, and method is not as important as result

A point that must be kept in mind is the condition of air in the hatching chamber There must be some movement of air fresh air must come into the machine and exhaust air must go out, but the ventilators cannot be opened up far, otherwise humidity will not be maintained Circulation of air can usually be arranged by having two inlet ventilators approximately one inch in diameter behind the blade in a hatching compartment for 1300 to 1400 eggs, and 1½ inches in diameter in a 3000-egg compartment The ventilators can be half to three quarters open, according to the weather this will allow sufficient air to be drawn in for a full compartment of eggs Two outlet ventilators of the same size can be one eighth to one-quarter open If there are no ventilators in the door do not have it tightly closed, if it is an easy fitting door some air can escape around it

When only one-third or one-half of the compartment is filled—perhaps

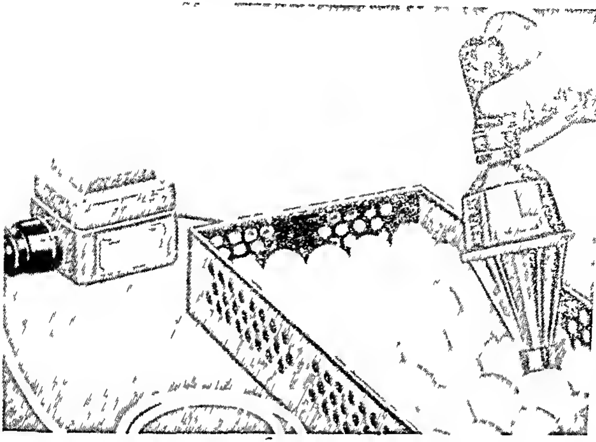
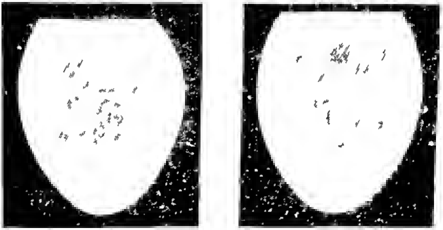


Fig 60 *Above* Proprietary type of testing lamp, which enables detection of fertile eggs at an early stage of incubation *Below* A fertile egg (right), and a clear, infertile egg



lines can be seen in a fertile egg, and the egg is dark in appearance, the air cell is about five-sixteenths of an inch deep (See *Fig 60*)

Infertile eggs at the early test will show clear, as with a fresh egg, except that they have a larger air-cell Eggs with a small spot (like a pea) fixed in position, and those with a red line running right across them, have ceased development (the germs have perished) and they will have to be discarded

At the eighteen-day test approximately two-thirds of the egg should be dark and a pulsating movement observable at the edge of the air-cell The egg should not be showing clear at its small end If it is, development has not been correct possibly humidity has been too high or temperature too

Chickens should be well dried out and ready to be taken out about 1 p m on the twenty-first day As a guide, the glass in front of the hatching chamber should be wet inside, owing to condensation, and water will be running down the glass when the wet bulb thermometer reading reaches about 96°F If moisture and fluff on the glass block the view of the thermometers and of the chickens hatching, the door should not be opened, even though the glass needs wiping (a hand-wiper of the type formerly used on car windows should have been installed—it is operated from outside to keep the glass clear)

TESTING EGGS FOR FERTILITY

Eggs should be tested for fertility at an early stage, and again at the eighteen-day stage (when they are ready to be transferred to the hatching chamber) Improved types of lamps have made it possible to test eggs after one full day of incubation, but unless conditions are perfect and the eyesight of the tester is excellent (particularly when eggs are brown) there would be no advantage in selling the clears as near first-grade eggs if, for example, two eggs on a tray of one hundred were passed out in error Therefore it is suggested that testing at three days for White Leghorn eggs and a day later for heavy breeds will give quite a good egg for market (although not a first-grade one), and will enable the development to be seen clearly With ordinary home-made lamps the fertility test should take place at seven days The type usually consists of a 60 watt globe in a container with a hand-piece and a cone at the side, the open end of which measures about one inch in diameter A small piece (about half an inch) of bicycle-tube pushed on the end makes an easier job of the testing

Many operators do not test until the eighteenth day because the trays in some machines have no individual wire divisions (others have this provision for each egg separately) The eggs are at an angle when turned, and the gaps have to be filled with some packing material (this does not apply to the small kerosene-operated machines in which eggs are turned by hand and are level at all times) The practice of leaving eggs till the eighteenth day is not recommended although it means a saving in labour, the machine will be crowded, which is not desirable from the point of view of the development of the chick in the egg Moreover, some bad eggs will result (i e amongst eggs with spider cracks left in the machine) Pollution of air in the machine in this way is detrimental to chickens It is conceded that high percentages are obtained by operators who practise this method, but improved results can be obtained by means of early testing, which enables overcrowding in the machine to be avoided

EGG-TESTING PROCEDURE

Eggs need not be removed from trays when they are being tested with an electric lamp Tests should take place in a darkened room or should be carried out in the evening At three days (or earlier), darkening of the egg is apparent and the germ can be seen developing and some trace of bloodlines is visible At seven days the movement of the developing chicken is clearly visible—this is the sign that life is present Red spider-like radiating

low The air-cell should be approximately three-quarters of an inch deep. A few eggs may be chipped—this is quite in order if the test is left until the actual transfer, which can be on the morning of the nineteenth day. Some hatcheries use a striplight under the tray for testing at this stage

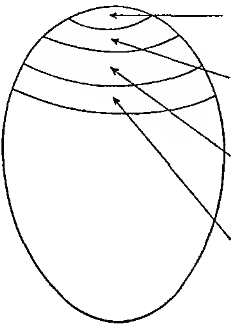


Fig 61 Size of air cell at various stages of incubation when humidity conditions are correct, controlled by wet bulb readings as given

METHODS OF IDENTIFYING CHICKENS

Chickens to be marked for progeny breeding can either be wing-banded using a light-aluminium numbered wing-band with a wire loop or clipped and sealed on the wing, or have the web between the toes punched Fifteen toepunch combinations can be used, ranging from a single punch up to one on all four webs, and combinations in between An electric toe-punch (a wire heated till glowing red) is excellent for the purpose, for it cauterizes the hole as it punches, and there is less danger of the web growing together, as may occur when it is not cleanly cut In order to identify the progeny of various males or separate families, chickens are punched or banded as taken from the hatching trays The use of small pedigree wire baskets, in which the eggs are placed when transferred, will enable chickens to be kept separate Another method is to subdivide a hatching tray with wire partitions and have a wire-mesh lid on the tray

DISINFECTION AND FUMIGATION

Strict hygiene is necessary with all incubators Adequate cleaning out and fumigation are more difficult in a machine when hatching and setting are carried out in the same compartment. When a separate hatching chamber is provided, it is very much easier to keep it clean, and in forced-draught machines a separate chamber is most desirable At the beginning and end of the season the machine and trays must be cleaned out dry, and

12 *Thermometers* Carefully test all thermometers each season before use. A rough check is to take one's own temperature—if the reading is 98 4°F. the thermometer will be a good one A thermometer reading with a two-degree inaccuracy, particularly if it is two degrees under the correct temperature, could cause almost a complete failure in electric forced draught machines Small still-air machines are less sensitive in this respect, but accuracy should be maintained

13 *Dead in Shell* If death in shell comes in the early stage (three to five days), insufficient turning, rough handling in collection or transport, incorrect fumigation, or incorrect temperature could be the cause If death in shell has occurred at twelve to fourteen days, suspect excess moisture in the early stages, general condition of the breeding stock, or incorrect feeding such as insufficient riboflavin in the feed If death in shell has occurred at the last stage (eighteen to twenty-one days), temperature, humidity, or ventilation have not been right Other causes could be rough handling in transfer or chilling through a delay in the process of transfer

14 *Weak and Small Chickens* Weak chickens can result from overheating, small chickens from small eggs or insufficient moisture Chickens breathing heavily may be affected by disease or by too much moisture Musty chickens often result from low temperatures or insufficient ventilation

GUIDE TO INCUBATOR-ROOM ROUTINE

The following schedule is a suggested routine covering the necessary operations in the incubator-room It is for electric-incubator machines with separate hatching chambers that hatch once weekly For combined machines (hatching and setting in the one compartment) adjust the setting-chamber readings to 80°F

Day	*Setting chamber*	*Hatching chamber*	*Loading, testing and hatching routine*
Monday	Incubation temp 100°F Wet-bulb reading 82°-83°F Turn eggs a m and p m	Temp 100°F Wet-bulb 92°F a m	7 a m load eggs in machine If large type machine load eggs Sunday evening 9 p m and calculate from Monday 7 a m Also check that hatching chamber ventilators are well open In the morning test eggs loaded on previous Monday if ordinary testing lamp used 12 30 p m to 1 30 p m, clear hatch from eggs loaded three weeks previously and box chickens for sexing or transfer to brooders Clean, disinfect, and fumigate hatching chamber Fill wet bulb bottles and water trays (and drip tank if used) Clean and disinfect room
	(Temperatures are given in Fahrenheit readings To convert to Centigrade take F reading, subtract 32 and then multiply by $\frac{5}{9}$ For example, $95°F - 32 = \frac{63 \times 5}{9} = 35°C$)		

1 *Preparation* Before eggs are set the machine should be run for a few days to check for temperature variations and general performance It is a sound precaution to have the machine serviced by an electrician before the season starts this can save losses from motor trouble, burnt-out elements or possibly short circuits Have on hand spare capsules, thermometers, mercury tubes, micro-switch, and an element Organize these matters in the off-season

2 *Belts* Loose or worn belts can mean a slipping pulley, which affects circulation of air in the compartment Loose or worn belts should therefore be replaced

3 *Temperature Variations* Check the control to see that it is working freely and will cut in and out on one-quarter to one-half of a turn Sluggishness in this respect can result in a jammed control, with the possibility of total loss of eggs or chickens Also check the alarm system control in the same way Carry out a test with the alarm system If the alarm is not working efficiently power breaks or a rise in temperature may occur unnoticed

4 *Age of Eggs* Setting of eggs well over one week old (or running at a low temperature—e g one degree below the correct mark) can cause late hatching

5. *Turning of Eggs* Always bring the lever over gently. The eggs should not be roughly shaken, particularly in the delicate early stages

6 *Time of Turning* Turning should take place night and morning, at the same times each day if at all possible

7 *Infertile Eggs* Causes of infertile eggs are (*a*) insufficient or too many hens per male bird, (*b*) underfed males, (*c*) lice-infested males, (*d*) eggs held too long, (*e*) overfat hens, (*f*) cross-mating of a light and heavy breed (debeaking of the heavy breed females mated with light breed males will help here), (*g*) cold conditions early in the season, and (*h*) very inbred lines

8 *Moisture Control* A thick wick in the wet-bulb thermometer will give a lower temperature than required, and a thin wick that becomes hard will give too high a reading Inefficient wicks can be a major cause of poor hatches

9 *Control of Ventilators* Ventilators should be neither closed right up to hold humidity nor opened too much to reduce it Instead, the control should be carried out by reducing or increasing the surface area of water in the trays Insufficient ventilation can cause many "dead in the shell" chickens

10 *Air-circulation Speed* Too slow a circulation will result in hot and cold places in the machine, and too high a speed will mean excessive drying-out of the eggs Check the recommendations for the type of machine If pulleys are replaced on the incubator see that they are of the correct size

11 *Malformed or Crippled Chickens* Excessive low or high temperatures are the principal cause of these, and another cause is incorrect turning of eggs or setting eggs wrong way up in the trays or deficient ration

12 *Thermometers* Carefully test all thermometers each season before use A rough check is to take one's own temperature—if the reading is 98 4°F the thermometer will be a good one A thermometer reading with a two degree inaccuracy, particularly if it is two degrees under the correct temperature, could cause almost a complete failure in electric forced draught machines Small still air machines are less sensitive in this respect but accuracy should be maintained

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Day	*Setting chamber*	*Hatching chamber*	*Loading, testing and hatching routine*
Tuesday	As for Monday		Check fertile eggs on hand for cracks, texture, and weight, and store ready for setting, keeping out of draughts, or load into trays in racks, large end up
Wednesday	As for Monday		As for Tuesday
Thursday	As for Monday		Check and set out fertile eggs as above Prepare hatching chamber Test eggs loaded on Monday for fertility if using new type testing lamp
Friday	As for Monday	Temp 100°F Wet bulb 83°F	Switch on hatching chamber early in the morning Late in the afternoon transfer eggs loaded 18 days previously *(or* this can be left till Saturday morning early) Do not overload hatching trays Adjust ventilators as set out in text Only put in sufficient water-trays to hold normal setting humidity Do not delay unduly the transfer of eggs on the trays
Saturday	As for Monday	Temp 100°F Wet bulb 83°-84°F early a m and 93°-94°F by late evening	Check fertile eggs and load trays for setting Monday (setting trays made available by transfer on Friday late or early Saturday) Put on drip tap or add extra water trays at 12 noon Reduce opening of ventilators as set out in text, i e *approximately* $\frac{1}{4}$ to $\frac{1}{2}$ open inlets and only $\frac{1}{8}$ open outlets
Sunday	As for Monday	Temp 100°F Wet bulb 96°F a m 97°-98°F p m	Checking only 9 p m to 11 p m according to hatch progress remove water-trays and stop drip if this is used Open ventilators as required (Leave chickens in trays until 1 p m Monday) Open doors slightly if necessary to reduce temperature if a big hatch is coming off If a small hatch, ventilators can be half opened in evening and fully opened in the morning Load eggs 9 p m if necessary (*vide* text)

The operation of incubators on these lines has given excellent resu On settings of many thousands of eggs the average under normal cond tions, has worked out at well over 75 per cent of all eggs set and over 95 pe cent of all eggs transferred to the hatching chamber On occasions durir a season 100 per cent of all eggs transferred (with over 90 per cent of eggs set) have been hatched when the stock is first-class The average for White Leghorns, which usually give good fertility is usually on 80 per cent of eggs set and just on 96 per cent of eggs transferred to the hatching chamber Crossbreds have been above this It is considered that these results will be very close to the maximum possible when authentic records are kept

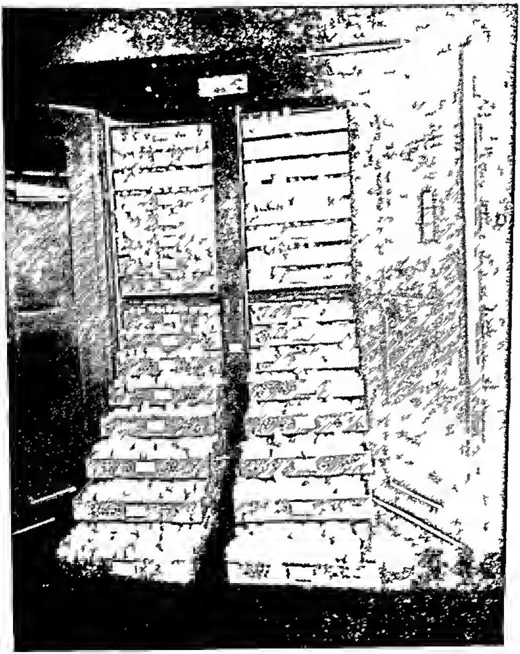

Fig 6? Thousands of chickens from well bred blood tested stock hatching in a large electric incubator

These figures will not of course be attained for the opening hatches of the season In practice it is found that early hatching with cold weather conditions for the breeding stock, and the machine not fully loaded, gives a lower percentage, and normal results are usually attained by the third loading when all compartments are full At the end of the spring season results reach the maximum

INCUBATION PRACTICE FOR SMALL KEROSENE INCUBATORS

Many beginners and those keeping poultry as a hobby obtain excellent results with small incubators, but to help those having poor hatches the following suggestions may be of assistance

Small flat-top machines are usually operated by kerosene, although they can be electrically heated by an immersion heater in the tank, which is cut off and brought on by means of a capsule regulator Some have a regulator damper for temperature control, or a sleeve control on the lamp Others replace lamp with electric heater when power is available

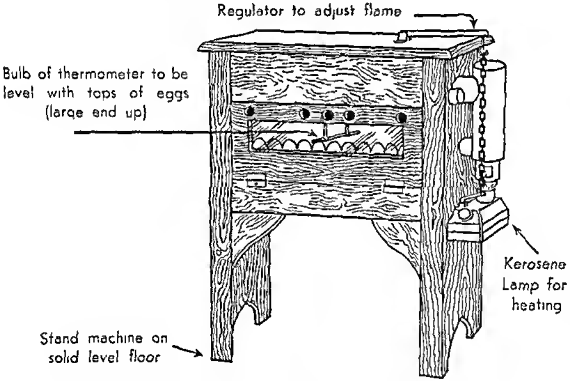

Fig. 63 Illustration of one type of small kerosene incubator

Variations in temperature must be avoided, hence the room, as for electric cabinet machines, should be insulated A room in a house or a separate lined and ceiled room is quite suitable, but a veranda or an iron shed such as a garage will not be satisfactory A machine cannot maintain a steady temperature unless the room in which it stands is insulated against the extremes of temperature that occur in the winter and during the incubation season, when conditions range from frosty nights to warm spring days

Ventilation of the room should be provided by windows or shutters The aim being to keep the air sweet, the room must not be stuffy or badly ventilated

HANDLING THE SMALL INCUBATOR

Before eggs are set in a small incubator, run it for a few days This will enable you to check for variations in temperature It should not vary more than one degree on either side of the correct mark, which is 103°F The thermometer bulb must be just level with the tops of the eggs—this is very important In electric machines the heat is driven through the chamber, but in small kerosene-operated machines it is radiated from a tank or from hot-air pipes to the eggs, and temperature varies according to the distance between tank or pipes and eggs

Eggs should be turned by hand twice daily from the second day to the eighteenth, this is needed to prevent the germ or embryo "sticking" in one position Always do this before tending the kerosene-lamp—for oily hands can spoil the egg or prevent the growth of the chick When turning, reverse the tray so that eggs are turned in the opposite direction each time Do not delay when turning, otherwise the eggs will get too cool, which will prolong the hatch The eggs from the corners should be brought to the middle of the tray and vice versa—this will offset the result of any variations in temperature that may occur in the chamber. Eggs are usually laid flat in this type of machine, but a larger number will fit into the trays if they are placed big end up In some small incubators automatic turning with eggs on wire grilles is successfully used, eggs are turned by a "roll over" movement Grilles are removed at eighteen day stage and thermometer is then lowered

Before each season, renew the wick and clean out the lamp Fill it daily, trimming the wick and cleaning out the lamp each time Keep it clean always and never overfill it Over full lamps can cause fires After cleaning the lamp do not forget to hook the chain to the regulator

Control of moisture is important in these small machines, as in the larger ones, and for this type it is usually safe, in normal spring weather, to have the moisture-tray full throughout the hatch and to refill it with warm, fresh water on the seventeenth day If there is wet weather early in the season it may be advisable to refrain from putting water in the tray until the seventeenth day The advisability of this can be ascertained by checking with a wet bulb A check on the size of the air-cell will also indicate whether more or less moisture is needed

Fertility tests should be carried out at the seventh day (or earlier) and at the eighteenth day Turning is discontinued on the eighteenth day, and the machine should not be opened until the hatch is complete For testing technique, which is the same as with forced draught machines, refer to pp 136-7.

If humidity is sufficient, moisture should show on the glass in front of the machine by about the twentieth day The moisture-tray should be provided with a piece of hessian raised in the centre to increase evaporation In some moisture-trays there is a raised portion in the middle, which enables the air to flow through Blocking some of the inlet holes helps to raise the humidity If still further moisture is required, wet sponges can be

These figures will not of course be attained for the opening hatches of the season In practice it is found that early hatching with cold weather conditions for the breeding stock, and the machine not fully loaded, gives a lower percentage, and normal results are usually attained by the third loading when all compartments are full At the end of the spring season results reach the maximum

INCUBATION PRACTICE FOR SMALL KEROSENE INCUBATORS

Many beginners and those keeping poultry as a hobby obtain excellent results with small incubators, but to help those having poor hatches the following suggestions may be of assistance

Small flat top machines are usually operated by kerosene, although they can be electrically heated by an immersion heater in the tank, which is cut off and brought on by means of a capsule regulator Some have a regulator damper for temperature control, or a sleeve control on the lamp Others replace lamp with electric heater when power is available

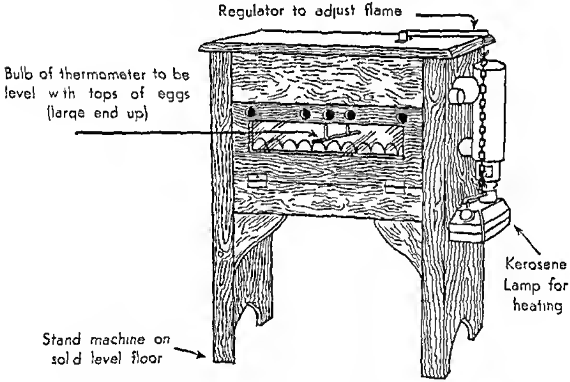

Fig 63 Illustration of one type of small kerosene incubator

Variations in temperature must be avoided, hence the room, as for electric cabinet machines, should be insulated A room in a house or a separate lined and ceiled room is quite suitable, but a veranda or an iron shed such as a garage will not be satisfactory A machine cannot maintain a steady temperature unless the room in which it stands is insulated against the extremes of temperature that occur in the winter and during the incubation season, when conditions range from frosty nights to warm spring days

suspended about one to two inches above the eggs Another method, which saves opening the door, is to fill a fly-spray container with warm water and direct the spray through the ventilation holes as needed

A check on humidity should be made between the third and seventh days and the eighth and eighteenth days This is done by using a wet-bulb thermometer with the bulb at the same level as the incubator thermometer Refer to pp 130 1 for method of making a wet-bulb thermometer Two or three inches of wicking will suffice The reading should be 85°F to 88°F

From the eighteenth day have the tray full and add further moisture if required (using the fly-spray container as described above) A check on the wet bulb reading should show that between the eighteenth and twenty-first days the readings gradually rise, until on the evening of the twentieth day the reading should be in the vicinity of 95°F to 98°F, and moisture should be showing on the front glass at this stage The condition of the woodwork inside the machine has a bearing on the humidity dry timber will absorb moisture, hence it is advisable to see that the hatching chamber is painted or sealed inside with shellac varnish before commencing the season's incubation

INCUBATION SCHEDULE

In the hope that it may be of assistance to the operator of a small kerosene incubator, a suggested routine is outlined as follows

1 Place the eggs in the machine with big ends uppermost

2 Set the eggs early in the morning to allow the correct temperature to be obtained by evening and to enable the regulator to be checked so that there is no danger of overheating Eggs in the early stage of incubation are very sensitive in this respect It is advisable to calculate the time of hatch from the time when eggs attain the correct temperature, this is usually eight to ten hours after setting. Hence, if hen eggs were set in the morning the hatch would be due in the evening twenty-one days later

On the first day check the temperature and see that it does not exceed 103°F

On the second to the seventh days maintain the temperature at 103°F Turn eggs and return them to the machine as quickly as possible

On the seventh day test eggs for fertility They can be tested with the help of a torch held behind a piece of cardboard that has a hole cut in it to the shape of the egg—but slightly smaller than a 2 ounce hatching egg The germ should be showing movement, and it should be possible to see small red lines and a clouded appearance An infertile egg will show clear, similar to a fresh egg, but will have a larger air cell Do not have the eggs out of the machine any longer than necessary A testing lamp can be used if available

On the eighth to the eighteenth days turn the eggs daily as usual As the hatch progresses it will not be necessary to return them to the machine so quickly, for they will now lose heat less rapidly From the eighth day onward it will be noted that temperature will increase slightly This is quite in order, readings can be up to 104°F by the end of this period At the seventeenth day replace the water, or fill the tray for the first time with warm, fresh water

At the eighteenth day test the eggs Those suitable for leaving in the machine will have an air-cell occupying approximately one-quarter to one-third of the egg, with the remainder of the egg dark Movement of the chicken can be seen at the edge of the air-cell

On the eighteenth to the twenty-first days do not turn eggs, and do not open machine, if you do so, there will be loss of moisture and heat Beginners with incubation are often tempted to do this just to check on progress of the chickens, but this practice will result in a poorer hatch because humidity will be reduced All chickens capable of hatching should get out if moisture, turning, and temperature have been properly attended to Do not help any chicks out of the shell—these rarely survive The temperature will tend to increase, but it will be in order if it rises to 105°F Moisture should show on the glass by the twentieth day if all is well with the hatch If extra humidity is required, add wet sponges or close up some of the ventilators A fly-spray container filled with water will do for this purpose, and another method is to have extra water-trays on the floor under the incubator The wet-bulb thermometer should register 95°F to 98°F by the evening of the twentieth day

Hatching should be over by the evening of the twenty-first day, and chickens will be ready to take out of the machine, but it is usually better to leave them until the morning of the twenty-second day If a good hatch has been obtained chickens can be placed in a chicken box of suitable size, or transferred to the brooder, which should be warmed to between 90°F and 95°F

NATURAL INCUBATION

Hatching with a broody hen may appeal to a small producer who wants to raise a few chickens The usual difficulty with broody hens for this purpose is that they are not readily available during the correct season Also, for commercial purposes, this natural characteristic of broodiness is being bred out as much as possible A few suggestions will now be given to assist those using hens for setting

SETTING A HEN

Make sure that the hen is really broody before risking a setting under her She can sit on a few eggs for a day or two before being given a full setting—normally fifteen eggs for a good-sized hen Place them under her at night A good broody hen can care for up to twenty chickens, and some small producers have had success by placing day old purchased chickens under a broody hen at *night* (this is important) A hen will usually refuse chickens if they are put with her during the day, and she may even kill them if they are left to her

THE NEST

The nest should be large enough for the hen to be comfortable One approximately 15 inches square with the front out would be ample The box is open in front except for a 3- or 4-inch cross board at ground level,

suspended about one to two inches above the eggs Another method, which saves opening the door, is to fill a fly-spray container with warm water and direct the spray through the ventilation holes as needed

A check on humidity should be made between the third and seventh days and the eighth and eighteenth days This is done by using a wet-bulb thermometer with the bulb at the same level as the incubator thermometer Refer to pp 130-1 for method of making a wet-bulb thermometer Two or three inches of wicking will suffice The reading should be 85°F to 88°F

From the eighteenth day have the tray full and add further moisture if required (using the fly-spray container as described above) A check on the wet-bulb reading should show that between the eighteenth and twenty-first days the readings gradually rise, until on the evening of the twentieth day the reading should be in the vicinity of 95°F to 98°F, and moisture should be showing on the front glass at this stage The condition of the woodwork inside the machine has a bearing on the humidity dry timber will absorb moisture, hence it is advisable to see that the hatching chamber is painted or sealed inside with shellac varnish before commencing the season's incubation

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On the eighth to the eighteenth days turn the eggs daily as usual As the hatch progresses it will not be necessary to return them to the machine so quickly, for they will now lose heat less rapidly From the eighth day onward it will be noted that temperature will increase slightly This is quite in order, readings can be up to 104°F. by the end of this period At the seventeenth day replace the water, or fill the tray for the first time with warm, fresh water

5 *Testing* Check some eggs as early as possible (two to five days) to see if germination is proceeding correctly (the clears can be sold) Test at the eighteenth day, and transfer to hatching trays eggs that have developed fully

6 *Ventilation* This should be watched closely, for neither too much nor too little is desirable

7 *Humidity It is very important to maintain correct humidity* Refer to the text for suitable humidity readings In general, ample moisture is needed for the last three days for hatching

8 As a matter of routine check your alarm system regularly check to see that your machine and room are in a sanitary condition, and look over the list of causes of poor hatching

9 Select an incubator of the correct capacity for your particular purpose It is better to have it larger rather than smaller than the size thought necessary—cost does not increase in proportion to size The incubators available, which are made in Australia, are as efficient in operation as those of other countries and are usually comparable in cost This applies to all types produced, ranging from the small kerosene incubators to the large capacity, fully automatic, electric machines

10 Refer also to Appendix 6 for additional information on handling of incubators of various types, and in particular the intermediate size forced draught type of electric incubator

Note The information given in this chapter, when coupled with the above Appendix, will supply a comprehensive range of data on incubation, needed for officers in developing areas

and the bottom of the box should also be open This will enable the hen to sit on the ground and usually allow for necessary moisture A precaution that is worth while if there is any danger of rats eating the eggs, is to nail half-inch-mesh netting across the open bottom of the box, set the box in the ground and replace the earth so that two or more inches of soil is above the wire This will prevent rats burrowing up from underneath. Straw can be placed on the earth also, and the whole nest then dusted with insecticide

NEEDS OF THE SETTING HEN

The hen should be carefully dusted with a suitable insecticide: lice will multiply rapidly on a setting hen if this precaution is not taken Work the insecticide well through the feathers, do not use strong-smelling disinfectants to spray the box—some of these preparations destroy the embryo in the egg

The hen should be fed daily at approximately the same time so that she will come off to feed and take exercise Also, she will not foul the nest if she does this If it is necessary to move her off the nest, do so very carefully. Test the eggs at about the ninth or tenth day—using a torch and working at night Be careful that the hen is free of lice near hatching time, otherwise the lice could cause the death of the young chickens Clean out any debris from the nest after the hatch is over. Water should be provided in a suitable vessel so that the chickens can drink without getting into the water. They can be fed with chicken mash, the same as is given to chickens in a brooder.

HATCHING TURKEY, DUCK, AND GOOSE EGGS

Incubation practices for turkey, duck, and geese eggs are similar to those for hen eggs, but allowance has to be made for slight temperature variation, higher humidity requirements, and different periods for incubation These matters are dealt with in Chapters 19, 20, and 21

Reference Incubation and hatchery practices are discussed in a bulletin of the Ministry of Agriculture and Fisheries, England It has been written by W M Allcroft, and it is No 148 of 1952

SUMMARY

The main points of importance in artificial hatching of hen eggs are:

1. *Room.* Have a suitable room for your incubator or incubators.

2. *Setting* Set only eggs of good shell-texture, of 2-oz minimum standard, from well-bred stock, correctly fed

3 *Turning* Turn trays, or eggs in a small machine twice daily—as a general rule, from second to eighteenth days Trays in a large machine should be staggered in correct sequence, as suggested in the text

4 *Temperature.* Maintain 100°F. in electric forced-draught machines, and 103°F to 104°F. in still air machines with the bulb level with the tops of the eggs

very rapidly during this stage, and they will be overcrowded, with consequent possibility of lowered production and impaired health in the birds when grown up The smaller a batch of chickens the easier to obtain even growth Early setbacks cannot be easily overcome hence provide a minimum of half a square foot per chicken on the floor, and one-sixth of a square foot per chicken in battery brooders up to four weeks for total space, including one twenty-fourth of a square foot in warm portion (Some oversea operators start chickens with more than double this space)

4 *Healthy breeding stock* must be used so that the chickens do not start life with a handicap With chickens produced from hens that are pullorum infected, brooding losses will be high despite good equipment and rearing skill Also, good breeding stock must always have the advantage of correct feeding Good breeding and good feeding of parent birds constitute important safeguards against chicken losses

5 *Correct feeding* is essential for growth of chickens and prevention of rearing losses Suitable balanced rations, either ready mixed or mixed on the farm, are necessary

Correct feeding must be combined with sufficient feeding and watering space, or poor growth and culls will result

6 *Sanitation* is a basic necessity to be kept to the forefront in any brooding programme, irrespective of type of brooder, whether using wire floors or litter A battery brooder with trays filled up with manure to the wire floor level, or an overcrowded pen of chickens on the ground are equally risky on the score of health and possible outbreaks of disease Brooders of the battery type should be cleaned out and disinfected between batches, and trays must be kept regularly cleaned With floor brooders maintain the floor litter in a dry, loose condition free from offensive smell This is the important point litter can be old and has even been carried from one season's chickens to the next, but it must be dry and loose For general use fresh litter each season is recommended Have the waterers arranged so that the litter will not become wet—most important in any floor brooding arrangements Dry conditions will prevent infection and possible heavy mortality

7 *Uniformity of surroundings* must be provided, for chickens are adversely affected by changes

After a few days in a restricted area suitably guarded or enclosed, chickens grow confident of finding their way back into the brooder Panic will ensue (particularly towards sundown) in such an event as the accidental closing of a slide or door leading from the cold portion to the warm portion of a brooder or from the outer room to the inner warm room The alarm of the chickens will be evident (if one is within earshot) from their shrill piercing notes, but if one is unfortunately unaware of the accident having occurred, then the result can be a very distressing one with possibly dozens of chickens dead—usually the best ones, which have burrowed underneath Always make sure, then, that doors, slides, or divisions have secure catches to prevent such occurrences If a bright light brooder (such as an infra-red brooder) is in use and the power goes off, the chickens are likely

CHAPTER 10

BROODING CHICKENS

Before discussing various types of brooders, it is advisable to consider requirements for the brooding of chickens, in order to have a clear picture of what is involved In this way heavy losses may be avoided and better results obtained with stock subsequently reared

BASIC REQUIREMENTS FOR BROODING CHICKENS

1 *Sufficient heat* in some part of a brooder or a shed for the chickens to remain comfortably warm, particularly in the early stages, without having to crowd together at any time of the day or night. This usually means a temperature of approximately 95°F. Do not rely on temperature readings alone—watch the chickens! If they spread out evenly in a circle, conditions are correct. (Thermometers can be defective: test them by taking your own temperature. A reading of 97°F. or 98°F. will prove a thermometer sufficiently accurate) The position of the chickens and the sound they make are of greatest significance. If they make a sound somewhat like a "purr" all is well, if you hear distressed chirping seek the cause It is necessary to have a level floor in the shed, since divisions, obstructions, or ledges will prevent freedom of movement—particularly necessary at night This rule will apply to both overhead or underneath heating systems

A well-insulated shed is of prime importance in avoiding temperature variations, whether floor brooding systems or battery-type brooders are in use Thus some type of shed lining is necessary, except in favoured areas with low rainfall and a reasonable temperature range. When frosts are experienced, it will be very difficult to keep chickens warm enough without either good insulation or a powerful heat source

2 *Light and ventilation* are also essential: a well-lighted brooder or room attracts the chickens and encourages them to start feeding Dark-coloured chickens are more difficult to handle in this respect. Either provide artificial light or construct the front of the shed so that it can be opened up or enclosed with glass or plastic cloth to ensure sufficient light. Ventilation is often neglected. It is bad policy to deprive chickens of proper ventilation in the hope of conserving warmth Have enough power in the heating unit to keep the brooder room warm while allowing fresh, sweet air to circulate; otherwise chickens will be in soft condition on transferring to their next quarters Humid hot-house conditions will cause trouble with chickens (Open-sided brooder rooms are used in some favoured areas with moderate climates)

3. *Avoidance of overcrowding* is essential The stated capacity of brooders often applies to the first week only. Chickens increase in size

one-sixth of a square foot per chicken. Four or five tiers are frequently employed in a battery brooder. After allowance for ample passageway, space for tending the brooder and room for cleaning the brooder trays, and some space for feed, chickens can be handled at the rate of approximately 500 in 80 square feet of floor area (8 feet by 10 feet) or approximately one-sixth of a square foot per chicken in the shed. When five tiers are used, there are two and a half to three times the number of chickens for a given floor space compared with the floor brooder. Consequently ventilation needs are much greater in battery brooders. Fresh air is free and necessary, but avoid draughts. With small numbers windows or louvres will suffice, but in large brooder rooms ventilator exhaust fans are usually employed in addition, to keep the air in a reasonably fresh condition in warm weather, although ordinary windows can cope in cold weather. Chickens are in an enclosed space within the brooder and it is vital to their immediate and future well-being that the air in the room be kept as sweet as possible, also that the trays are cleaned out frequently. This is absolutely necessary for the best results with the growth of chickens and is also tied up with the overcrowding factor. Respiratory and eye troubles can develop in crowded, dirty brooders apart from the stunting of growth and uneconomic mortality levels. The criterion for ventilation is one's own comfort in the room: if the surroundings smell fresh and pleasant, then all is well; if not clean out or open up ventilators

A SUITABLE ROOM

Small brooder rooms should face north for the maximum amount of light and sunshine during the winter and early spring months: moreover natural lighting is more economical. With large rooms containing many thousands of chickens artificial lighting is economical because the cost is spread over a great number of chickens.

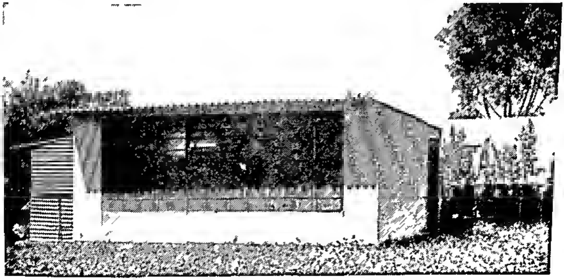


Fig. 64. A small type brooder shed suitable for battery brooders of 1000 capacity on a commercial unit. The louvres in front can be adjusted for ventilation; with the glass cloth (or plastic) used for the balance of the front, ample provision is also made for light.

to panic at the sudden darkness A kerosene light can safeguard against this (refer to infra-red brooder later in this chapter)

Another precaution that must be taken is to see that, when chickens are moved (from, say, brooder to rearing shed), the corners are rounded off, or that a brooder box *or* warm corner is provided, or that the shed is equipped with either a wire-mesh platform or a slatted platform Otherwise smothering will occur when chickens crowd into corners *Always have conditions (feeders, water system) as nearly the same as possible in new surroundings* For example, hang a pilot light in a shed to which chickens brooded under infra red lamps will be moved Risk of panic and possible crowding is a reason for vigilance for the first few nights after moving large numbers of chickens The heavy losses that can be incurred through one night's neglect in this early stage can nullify the work and care of weeks At a late stage, when training chickens to use one particular shed of several in an enclosure, a small yard must be attached to this shed for some days in order that they become used to it and regard it permanently as their own

The brooder shed should be set as far away from the laying sheds as possible This can be a big factor in controlling the spread of disease Isolation of chickens and young stock from adult birds through all stages of rearing is to be recommended as a safeguard

BROODING COSTS

The initial cost of a brooder will be of vital importance to many Outlay on brooders varies very considerably from infra red units to battery brooders The cost of power to be used must also be considered Electric brooders can be costly to run in some localities, and other forms of power may be used Generally a lamp of 180 to 250 watts is adequate for brooding 100 chickens in a suitable room, requiring 4½ to 6 units of electric power in 24 hours The same applies to smaller brooders—costs per head being usually lower in large brooders The cost of approximately 5c per chicken for four weeks' brooding (quoted on p 113) is based on an average of 15c to 18c per 100 chickens daily Hence 20c per day in the first fortnight and 15c per day in the last fortnight would be average figures on which to base calculations, when electricity is supplied at cost of 2c or 3c per unit Any reduction or increase will require adjustment Costs of other fuels e g kerosene or bottled gas, can be compared with this

BATTERY BROODERS

The majority of hatcheries, and a large percentage of commercial farms throughout Australia, use the battery-brooder system for the rearing of chickens to the month old stage For the benefit of those new to poultry-farming, the term ' battery brooder" refers to the use of more than one brooder floor in a given space, which of necessity means wire floors with trays underneath each floor The labour of handling the chickens is reduced owing to the large numbers that can be efficiently tended with a comparatively small floor space Whereas a floor brooding system requires half a square foot per chicken, the battery brooder per floor requires only

period. Many large plants where the electric system is used are equipped with an auxiliary plant to safeguard against breaks in current supply The bottom floor is nearly always the coolest in a battery brooder, as all other floors have heating elements both above and below Some small brooders overcome this disadvantage by having an extra heater under the bottom floor Another method in other types is to have the bottom-floor adjustable partition between warm and cold areas set as low as possible without preventing the passage of the chickens, other floors can have the partition set at a greater height This will be reasonably effective in a brooder with only one control for all floors Individual floor controls (for kerosene or electric brooders) are easier to handle These suggestions apply when a brooder is filled with chickens all of one age

With large battery brooders holding thousands of chickens the normal practice is to have the youngest on the top floor and to move or "drop' them down each week Hot water rises to the upper pipes of the circulation system, and thus the lower floors, with reduced temperatures, will house correspondingly older chickens The use of this principle with the large brooder system amounts to an automatic hardening-off system

CONTROL OF HEATING IN SMALL BATTERY BROODERS

In the smaller brooders this hardening-off is accomplished by a gradual reduction of temperatures by means of the capsule-operated controls

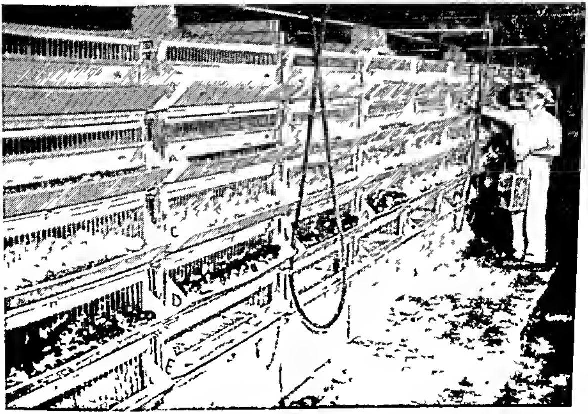


Fig 65 A large, pipe-heated battery brooder with capacity for 10,000 chickens Chickens are usually placed in the top tier at a day old, and brought down one floor after every week, being hardened off in the lower tier The convenient watering system consists of a hose with a trigger attachment at the end to control the water flow, each hose serving several sections

The room, as mentioned previously, should be 80 to 100 square feet for 500 chickens To facilitate cleaning operations, a generous allowance of up to 150 square feet for 500 chickens can be made Height will be determined by the number of floors used An eight-foot ceiling would be necessary with five tier battery brooders For the northerly aspect provide ample window space, and also some window space on the other sides when light is shining on the feeders from all sides of the brooder artificial lighting need not be arranged

Without sufficient light, chickens—heavy breeds in particular—will not start feeding early enough Some operators mix the breeds in the early stages for the reason that light breeds teach heavy breeds to feed However, this is not needed if ample light is provided on feed and water It has been suggested that, in order to prevent toe-picking troubles, direct sunlight should not shine into brooders Filtering of sunlight through red curtains or red paint on the windows has been used Suitable diet usually obviates toe-picking Debeaking will control this problem if it persists with correct conditions given

Adequate insulation of the walls is necessary A shed with lining and ceiling will suffice For large units a brooder room is usually built on substantial lines as for house construction with solid walls and ceiling, an asbestos roof makes a ceiling less important A good floor such as concrete is required An estimate of costs has been given in Chapters 3 and 8

HANDLING EQUIPMENT

Provision should also be made in the room for a convenient supply of water Hoses attached to overhead lines with a trigger device so that the troughs can be quickly filled are a labour saving investment for the large brooder room Alternatively arrange automatic control of the water troughs A portable food bin will greatly facilitate the feeding of chickens This can be mounted on swivel castors with rubber tyres and wheeled alongside the brooders For a small brooder room a watering can and a 44-gallon drum with a large scoop will provide reasonably good facilities A suitable wheelbarrow or wheeled bin that can be taken through the brooder room is a necessity so that the trays can be quickly tipped and scraped The use of some medium on the trays to prevent the droppings adhering is essential Sawdust preferably, or sand according to availability and cost, can be used with success Other mediums can be used if in cheap local supply These methods work satisfactorily with brooders of up to 10,000-chicken capacity, and reduce labour requirement considerably

BATTERY-BROODER FEATURES

The heating system can be kerosene or electric in individual battery brooders Where batteries are built in a long line the familiar hot water pipe heating system operating with a coke or oil furnace or an electric heater is probably the most efficient heating unit that can be used Heat is easily controlled, no fumes are experienced, and it is economical to run Also in the event of failure in the heating unit—due to a neglected fire or a break in current—the pipes will remain warm for some considerable

cannot "win" against this question of overcrowding—well-grown chickens have a good start in life and will respond with better health and laying The correct number of chickens at the start is that which will be right at four weeks of age This is much better than talking of reducing later on—all too frequently neglected

HANDLING CHICKENS IN BATTERY BROODER

Preparation of the battery brooder Have the brooder set up so that it is not in a draughty position, and see that light shines on to the feed- and water-troughs If not, provide artificial light A wire floor is used in the battery brooder, usually of half-inch either round or square mesh, but to assist warmth for the first few days (and up to six or seven days under very cold weather conditions) it is normal efficient practice to cover the wire floor of the warm portion and part of the cold run in each tier used with some material such as newspaper This may not be needed in a room with several brooders installed (Some have used hessian with success) The newspaper (which can be renewed every two or three days, or seven sheets started with one pulled off daily) inside the warm portion is sprinkled with dry, sharp sand (To dry sand in wet weather put it on the brooder floor a day or so before required and warm the brooder) Feed is also sprinkled over the paper by some operators to start feeding Early feeding will also be encouraged by providing for a few days a small feeder inside the brooder against the edge of or in the warm portion on the paper and also a small waterer over the wire in the outer cold run area which the chickens cannot get into These extra precautions will make sure of teaching the chickens to feed do not place complete reliance on the feeders at the side of the brooder, as heavy and unnecessary mortality has occurred through chickens not finding their feed soon enough in a brooder Also adjust slides (if used) to a one-inch opening to prevent chickens getting out Fill all feeders and waterers both inside and outside If the battery floor is a long one cut off the area about eighteen inches to two feet from the edge of the warm portion so that for the first two or three days chickens do not roam the full length until they are accustomed to the surroundings In battery-brooder floors of the square rather than rectangular type this should not be necessary Also where feed and water are available at the side of the warm portion, this part only may be used for two or three days *

TEMPERATURE

The temperature readings required will be given, but the safest guide is to watch the chickens If they spread out in the form of a circle open in the centre then conditions are correct Place one's hand in the brooder just above the floor and it should feel "pleasantly warm" The reading when this condition prevails should be about 95°F with the bulb of the thermometer two inches above the floor and the reading taken two or three inches

* One type of hot water pipe system brooder has battery brooder tiers on top with heated floor brooders for the chickens underneath after 14 days old—a combination of both battery and floor systems which gives quite good results

usually working on to a micro-switch in electric battery brooders, or by means of baffles and increasing or decreasing the height of the flame with kerosene-heated battery brooders With kerosene brooders always use lighting kerosene—not power—avoidance of fumes is essential *Do not fill a lamp to the top*, as kerosene expands when warmed, and this has caused fires and loss of brooder and chickens It is also necessary to keep wicks in good condition The blue-flame type lamp is recommended for greater heat and for absence of fumes Some small single-floor battery brooders (with a suitable pipe system that draws in fresh air by convection currents) use a single-flame lamp with a high degree of success Popularity of various makes is usually a fair indication of efficiency.

CONSTRUCTING BATTERY BROODER

It is suggested that home-made battery brooders, as a general rule, are risky in view of high cost of chickens and economic loss involved with high mortality If one had technical ability and wished to construct a battery brooder, it would be advisable to follow some approved type rather than attempt original designs Many well-known manufacturers in the various States produce very efficient battery brooders, and the cost is reasonable on a competitive market

CLEANING BATTERY BROODER

The battery brooder is efficient in relation to sanitation. The feed-troughs and waterers are outside the brooder, thus preventing chickens from getting into the feed or water and droppings from falling through to the trays underneath Provided that the trays are cleaned frequently and the floor is not overcrowded, conditions are dry within the brooder With regular routine attention high efficiency in relation to disease control can be achieved during the first month of growth in a battery brooder

IMPORTANCE OF CORRECT NUMBER OF CHICKENS

Avoidance of overcrowding is very important, particularly in a battery brooder Space required is not that for day-old chickens but for those of 3½ to 4 weeks of age * Brooder floors are often claimed to hold a number of chickens which is far too high, in order to indicate that the particular brooder is economical in relation to the number of chickens It is possible to arrive at the correct figure easily by taking the area of the floor, and allowing no more than six chickens per square foot at four weeks If this is exceeded, either the chickens will reduce themselves to the correct mark by mortality or there will be a percentage of "runts" or poorly-developed chickens This may be minimized by food supplements and so on, but one

* This applies in the normal type battery brooder with limited headroom In types where a greater head height is allowed the chickens have been carried on to six or seven weeks on the lines of a follow-on brooder with heat reduced or cut off In this case *allow three chickens per square foot at four to seven weeks.*

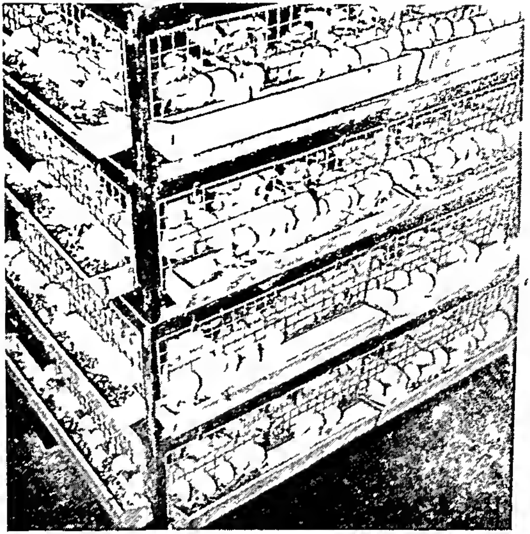


Fig 66 *Above* A single-unit, 4-tier battery brooder for 400 chickens Chickens have just been given greenfeed on top of the battery, mash being available at all times *Below* A battery brooder ready for chickens, with feeders and water trough in position An extra feeder inside is visible, and the brooder is thoroughly clean and has been disinfected The floor of the warm portion on the left hand side has been covered with paper and sharp sand Temperature controls and pilot lights can also be seen The electric light shining on feed and water promotes early use of feeders and water trough

inside the edge of the warm portion of the brooder This should be maintained as near as possible It should not go below 90°F In a suitable room the figure should be held with a variation of only 3° to 5° About the second week 85°F to 90°F should suffice and during the third week 80°F to 85°F In cold weather hold the figure higher In hot weather the reduction can be made earlier, but watch the temperature and how the chickens spread out Strength of heat source and efficiency of room insulation will be the factors controlling maintenance of temperatures at night This is vital to successful rearing, as chilled chickens crowding together for warmth are predisposed to disease and may suffer heavy mortality So make it a rule to have the temperature well up at the final check at night (as with all brooders) Chickens should be able to move away from heat in a well-constructed brooder, but should not pack together for warmth, *so maintain a little more heat rather than less than that required*

Note Do not rely wholly on thermometers—occasionally put your hand inside the warm portion to see that the heat is sufficient

FEEDING CHICKENS IN BATTERY BROODERS

The feeding of chickens in a battery brooder requires a suitable correctly balanced ration including substitutes for the lack of sunshine and outside exercise Suitable rations are described (pp 300 3) in Chapter 14 for those wishing to mix their own requirements, otherwise suitable mashes based on this type of ration can usually be purchased from prepared foodstuff manufacturers The battery ration fed as a dry battery mash, or alternatively in the form of granules or crumbles, will give good results A pullet well started in life is less likely to contract complaints during the remainder of the growing period

CURRENT BREAKS

Where electric brooders are used an alarm system should be incorporated so that breaks of current, particularly during the night, would be notified If incubation is being done on a big farm the alarm system should notify a break in supply If brooding only is done a control should be arranged to enable notification of the break in supply or an auxiliary heating system to be brought into operation Heavy mortality can occur if this is neglected

THE BATTERY BROODER

The battery brooder is a very efficient method of raising chickens For wire-cage laying plants it would be the logical choice, with birds being raised through all stages on wire, also for month old trade, where smaller groups of chickens are to be kept separate For meat raising plants, where cage rearing is used, it would also be the logical choice It is again stressed that overcrowding will defeat its efficiency and that ventilation is very important as a vital health factor with this type brooder

are finely divided, will answer the purpose (refer to Chapter 13 for information) The litter is usually spread over some dry sand or earth Earth floors, provided they are dry, can be used successfully, but it is normal to have an impervious floor such as cement About 3 to 4 inches depth of litter is needed Do not attempt brooding on sand only—this could be a cause of toe-picking The lamp should be surrounded by a guard or screen from 18 to 21 inches high and forming a circle $3\frac{1}{2}$ to 4 feet in diameter This screen can be made of heavy cardboard, bagging on wire netting, or hard board in preference to galvanized iron, which can be cold for chickens. It should be kept in position for three to five days according to weather conditions and effectiveness of brooder-room insulation Such a screen prevents ground draughts and also keeps the chickens from straying too far. Early in the season, or in any area where winters are heavy or when night temperatures are low and an unlined shed is used, it will improve results to have above the lamp a reflector or small hover about 12 to 18 inches in diameter (This also prevents damage being done to a lamp by drips from the roof due to condensation) This addition is recommended Weaning of chickens from the heat can be carried out by gradually raising the lamp 2 or 3 inches at the end of each week, although this will be governed by weather conditions The spreading out of the chickens is the best guide—as with all types of brooders

SHED SUITABLE FOR ONE HUNDRED CHICKENS

A shed 8 feet long by 6 feet deep and approximately $5\frac{1}{2}$ feet high in front and $4\frac{1}{2}$ feet high at back will be suitable for one hundred chickens for up to one month of age The shed can be of iron, asbestos, or cement blocks Provide a 5- to 6-inch gap at the back near the roof with a hinged board for use as required Iron sheds in cool climates will need lining Bagging or hard board have been used for this purpose The front can be closed in with solid material half-way and with a plastic or glass cloth screen for the rest The floor is to be preferably of concrete, but an earth floor can be used if the level is well above the surrounding ground After one month the chickens can be without infra-red light, having a cold brooder in the normal manner, although some have used an ordinary lamp of small wattage after this period until the chickens are roosting This saves any panic with chickens and the need for a cold brooder Only 50 could remain to 8 weeks of age if rearing intensively, but to laying stage if on range—the balance to be moved to another shed of same size Handling method and use of litter are to be as described for the larger infra-red brooder. (Further details of this type shed are given in Chapter 11)

INFRA-RED BROODER FOR COMMERCIAL PRODUCER

The same rules in relation to height of lamps above litter (14 or 15 inches to bottom of lamp) and number of chickens per lamp apply commercially, as for the small producer set-up discussed previously. A common type of unit consists of three lamps placed on a triangular frame at 2-foot centres wired for any desired number of lights This unit is normally suitable for 300 chickens—and possibly up to 350—which is a

FLOOR BROODERS

Brooders used where chickens are running on the floor of the shed vary in type whereas with the battery brooders the principles are common to all types (although considerable variations occur in methods of enclosing the sides, types of element used for heating, and types of feeding and watering trays) The features and handling of some of the more commonly used types will be discussed

INFRA-RED BROODER

This type of brooder is an efficient method of floor brooding of chickens These brooders are economical of labour, the litter keeps in good condition, and chickens can adjust their heat requirements easily There is no fire danger as with some brooders

Growth of chickens, owing to the bright light conditions with this type of brooder, compares well with those in a battery brooder, and is normally well ahead of other type floor brooders, even where artificial light is provided Installation cost is low and cost of heating reasonable—one lamp, which will brood 100 chickens under normal conditions, will consume one unit of power in four hours Temperature readings are not usually needed, and the chickens can be easily observed These remarks apply to the bright light infra red lamp Infra red lamps with a coloured glass are also successfully used, but extra light will be needed in the room to give the same growth rate Dull emitter brooders of the infra-red type are also used, but general results indicate higher installation cost and consumption of power for a given number of chickens Also there is no light visible, a fact that could be of some benefit under certain circum stances—for example, in the event of a power break there would be less panic among chickens than with the bright light Nevertheless, the unfortunate cooling effect would be comparable With bright light types, some operators keep a hurricane lamp either burning at night or in readiness to safeguard against this trouble True infra red brooding implies use of the enclosed light type, the dull type is exposed to the air and operates as a radiator element Its efficiency deteriorates more rapidly than that of the infra red lamp, dust and corrosion being chiefly responsible

The infra red brooder system is recommended as having a number of advantages for efficient economical floor brooding of chickens This applies where a regular supply of electric power is available

INFRA RED BROODER SET UP FOR ONE HUNDRED CHICKENS

One lamp of 250 watt size and working on 240 volt A C system will brood 100 chickens from one day to one month of age provided that 50 square feet of shed space is available The lamp should be suspended so *that the distance from the bare floor to the bottom of the lamp is* 17 inches, which means approximately 14 to 15 inches above the chicken litter The litter can consist of chaffed straw, shavings and sawdust, or good quality hay chaff (not damp), many other materials, provided they

In this way the heat is more concentrated and there is better protection for the chickens—and for the lamps if any condensation occurs under the roof. (Cold drips on to a lamp can cause breakage) Infra-red lamps can be used in a shed built with cement walls, brick or iron outside and lined and ceiled with some type of insulation board without a hover except in very cold areas or too large a shed, but the hover is a good safeguard for most conditions. Lining an iron shed with wheat bags cut open has worked satisfactorily for insulation and is economical

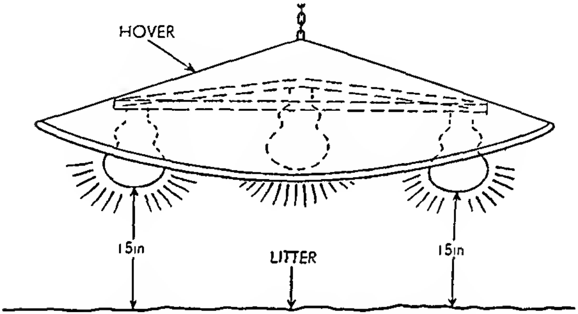


Fig 68 A 3-lamp, infra-red frame under a hover

SUITABILITY OF VOLTAGE

Some operators have had indifferent results with the infra-red lamps through having used the 240-volt globes on a 210-volt circuit This has meant that recommendations for number of chickens or distance above the litter would not apply A compromise can be made by using an extra lamp, making four lamps instead of three, and reducing the height to 13 inches above the litter, use of hover can also be considered The best way would be to obtain a transformer and step up the current Also, have the wiring done by a qualified person when taking long leads to a shed being used for infra-red brooding, or a voltage drop may occur and reduce the heating effect

Note Some poultry-keepers not on the power lines and who have a home lighting set may wish to use infra-red brooding on their plant This is rather difficult as it involves a fairly costly step-up transformer, and also is a heavy drain on the batteries It can be done, but the practical complications are rather considerable

INFRA-RED SYSTEM FOR LARGE NUMBERS

Some operators brood chickens in large numbers—600 and up to 800 have been brooded together, but such numbers greatly increase the responsibility of supervision, in view of the danger of heavy losses when

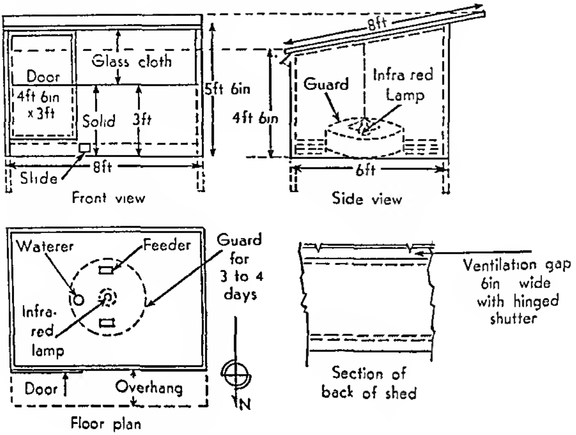
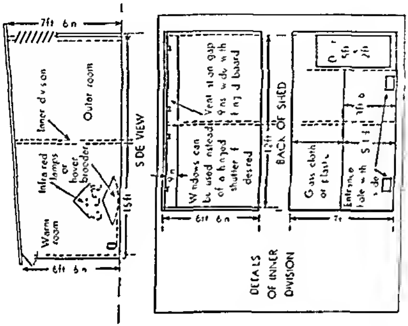
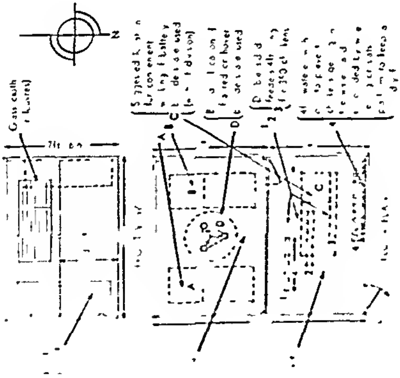


Fig. 67. Small shed 8′ x 6′ for infra-red lamp brooder, suitable for 100 chickens up to 4 weeks of age.

satisfactory number for good rearing results under this system. (In very cold weather brood only 250 chickens under three lamps.) The frame is suspended from the roof or ceiling so that the lamps are 14 or 15 inches above litter. It is also necessary to have a guard or screen as for the single-lamp unit, but it is larger in size—about 7-foot diameter is suitable for 300 to 350 chickens. Of the same materials as in the smaller unit, this screen should be 18 inches to 2 feet in height if used in a large shed without any internal division to cope with draughts and prevent straying of chickens. If used in a shed that has an inner warm room, the guard can be reduced to 12 inches in height, as draughts will not be such a problem. It has to be realized that draughts are more of a problem with this type of brooder than with some other floor brooders. A hover will be a safeguard against this possibility. Infra-red lamps are equipped with an internal reflector; they do not require any hover under mild conditions, but when the system is used in, say, an unlined iron shed in a district where low night temperatures are experienced (down to freezing-point in many parts of Australia for the first two months of the normal breeding season, with heavy frosts quite late in the year), then the use of a hover is recommended. It should be used in the manner of an ordinary floor hover, the conical type of shallow hover shaped like the top of a small water-tank. This covers the triangle frame and comes down only to the level of the bottom of the lamps, so that the bottom edge of the hover is approximately 15 inches above the litter.

suitable where more than one brooder set-up is required. As an alternative the shed can be built 15 feet long by 12 feet wide and divided near the centre, i.e. one room 8 feet by 12 feet, the other 7 feet by 12 feet—one room for the warm portion, the other as the inner cold run. This works satisfactorily as a single unit. The door in the division should be on the opposite side to the door by which entry is made to the shed. i.e one on the left-hand side, the other on the right-hand side. This prevents a direct draught to the inner room if weather changes occur when doors happen to be open





chickens pack together, particularly if a current break occurs Nevertheless, if the lights are well spread out this can be handled reasonably well—two triangles of three lights can be used, or a line of six or nine lamps at two foot centres has proved efficient This line is usually located against the rear wall so that the shed has a warm and a cold run, but a central line in the shed can be used The same floor space must be provided half a square foot per chicken—600 would require a shed of 300 square foot floor area to four weeks of age This method can also be adopted where a large number of cockerels are being brooded at one time on deep litter

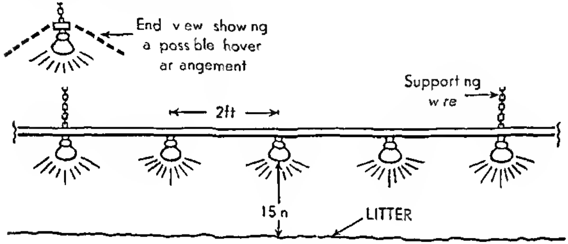


Fig 69 Infra red brooding lamps set in line

SUITABLE HOUSING

For housing infra red brooders, a lean to type of shed is suitable, constructed on the lines of an ordinary poultry shed The front can be closed in nearly half-way with solid material and the balance can be glass or glass cloth The shed should face north, in order to take advantage of the maximum amount of natural light, warmth, and sunshine during the rearing season As mentioned a shed 8 feet by 6 feet will suffice for 100 chickens A suitable sized shed to accommodate 350 chickens to one month of age would be 15 feet deep by 12 feet long The height in the front can be 7 feet 6 inches to 8 feet sloping down to 6 feet 6 inches at the back As many as desired could be built in line, making the shed 15 feet deep and multiples of 12 feet in length

A very important feature in the construction of a shed for infra red brooding is control of draughts This can be efficiently arranged by means of an internal division in the shed—the division to be solid up to 4 feet, *with the balance of glass cloth or glass substitute Place the division so* that the inner room is 8 feet deep by 12 feet wide, which leaves the outer room 7 feet deep by 12 feet wide (These shed measurements can be varied to suit varying size of materials or an existing shed) Thus partitioned, the shed corresponds to a brooder with a warm portion and an outer cold run This outer run is used before any outside yard is used, and in this case it acts as a neutral zone between the warm room and the yard—an important feature when weather conditions are cool This type of deep shed is

(or dry hay chaff) or some material of this nature. Litter only is used b, some operators with successful results. Then put the screen or guard in place so that the lights are in the centre of the 7-foot diameter circle f brooding approximately 300 chickens. The screen should be 12 inches high in the inner room of the subdivided shed or nearly 2 feet high in a shed not subdivided. Then place a one-gallon waterer or fountain for each hundred chickens.* Provide six or seven small open feeders for the first few days and then provide more space as the chickens grow—allow at least 6 feet of feeding space for each 100 chickens by the time they are three weeks of age. If an automatic type of waterer is not available, then it is suggested that each water fountain be placed on a shallow box—approximately 15 inches long by 15 inches wide by 3 inches deep filled with sharp sand. This will provide absorption for spilt water as the chickens are drinking and prevent wet litter. This is important as a control for coccidiosis. The lamps can be switched on a few hours before the chickens are placed in. Although they will heat up very quickly, it is just as well to have the shed comfortable for the chickens when brought in, beside ensuring that everything is in order. (Always have a spare lamp on hand.)

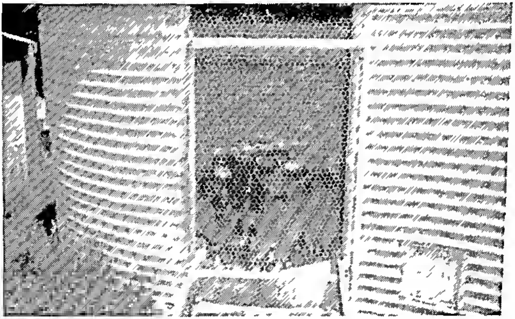


Fig. 71. A small brooder room used successfully for infra-red brooding. The room shown is circular and constructed as for a large rain-water tank with a conical top.

Handling Routine

The screen or guard can be kept in place for three to five days according to the weather; then move the screen back gradually over a period of a day or so. Provide feed and water in both rooms. No attention should then be necessary other than replenishing food- and water-supplies and stirring the litter if it becomes packed together.

Chickens normally take to the lamps very quickly, as they are attracted

* Allow for up to 2 gallons daily consumption per 100 to 4 weeks of age.

The inner or warm room can then be regarded as draught-proof—small openings 6 inches by 12 inches with slides for communication between the inner and outer rooms are sufficient for the passage of the chickens. In this case only the inner room need be lined and the saving on the lining of the outside room will balance the cost of the inner division, which does not require to be of heavy construction. With this alteration to the shed very little trouble will be experienced with infra-red brooding. If using as one room only, take greater care with the chickens and use a higher guard in the initial stages. Outside runs are optional, according to the rearing system that is to follow—if chickens will be placed on range the outside run helps prepare them for the move—otherwise brood intensively.

One of the reasons why the battery brooder proved successful (and before its advent the small outside brooders with a warm and cold portion) was this provision of warm and cold portions so that the chickens could adjust their heating requirements and also "harden-off". This also applied to the hot water pipe floor system. When a floor brooder such as infra-red is used the same provision should be made.

The roof of the shed can be of asbestos or iron and the walls of iron or asbestos (with a lining for the inner room) or cement blocks (which would not require lining). The internal division need not be lined—a single thickness will suffice. A concrete or solid floor is advised, although an earth floor has been used with success. If a concrete floor is not well dried out, a layer of an insulating material under the litter is advised beneath the lamps.

When a plant is being started with limited capital a brooder shed can be saved in the early stages by adapting a laying shed. Use a temporary division to divide the shed, making one end about brooder-shed size. Close the upper portion of the front of this with glass cloth. Work this portion as the brooder room, and the balance of the shed can be used as an outer run. This type of improvisation has been quite successful.

SAFETY MEASURES FOR OPERATOR

When installing the lights make sure that all connections are properly made. If using a single lamp it is hung in the manner of an ordinary electric lamp, but use rubber-covered cable for safety. With the triangle metal frames these are usually earthed to the frame and if an earth wire is located at the plug-in point use the three-wire lead. Provided sound rubber-covered cable is used there should be no worry if only a two-wire connection is used. These points are mentioned because one is dealing with the lamp and connections in the open as compared with an ordinary light lamp (located overhead) or the elements in a battery brooder (located well inside). *Do not switch on until the lamps have been placed in the sockets.*

CARE OF CHICKENS

Preparing Brooder Room

It is desirable to spread a three-quarter- or one-inch layer of sand over the brooder-room floor and then two or three inches of chaffed straw

If warm days are experienced and the shed temperature is high, the lights can be turned off, but take care to turn on again before shed temperature falls

[b] Increasing height of lamps

Another method by which the temperature can be reduced for the larger infra-red unit (three or more lamps) is the adoption of the same principle as that used for the single lamp, which consists of leaving the lamp (or lamps) on all the time and gradually raising the lamps to decrease the heating effect They can be raised two or three inches at the end of the first week (a day or so later in cold weather) and a further two or three inches during the third week This method is very satisfactory, giving a wide heat distribution, even if more costly in current than the gradual reduction of the number of lights Of course, they can be turned off as mentioned above on hot days

If chickens are being moved to a small rearing shed with a wire floored cold brooder in which they are closed up for the first few nights there will be no worry with the changeover

Nevertheless, when chickens are moved from an infra-red brooding unit to a large rearing-shed in greater numbers than 80 to 100 it is good practice, in order to avoid any panic among chickens because of change in surroundings, to retain either one infra red lamp hanging over the chickens or an electric-light globe or hurricane lantern This can be continued for a few weeks until they are roosting at night—these little extras are big factors in successful rearing

Mortality of Infra-red Chickens

Rearing results and growth rates have been very satisfactory in batches of 300 to 350 chickens Losses under good housing conditions and correct feeding have been under 3 per cent to 3½ weeks of age These numbers of 100 to 120 per 250 watt lamp would appear to be the highest permissible if good results are to be obtained Work on a maximum of 100 chickens per lamp if it can be arranged, with fewer (down to 80) under very cold conditions

Variation of the Hover Principle

Some operators have incorporated infra red lamps under the conventional hover of the type formerly used for kerosene brooding The use of one 250 watt lamp has been reported from New South Wales as having been successful with up to 300 chickens by means of a suitable hover arrangement with curtains used at the edge of the hover

Feeding

It is essential that feed for chickens under infra red brooders, particularly under bright lamps, should contain sufficient protein The usual battery mash, either as straight mash or in the form of granules, crumbles, or chick pellets, should be supplied Suitable rations for mixing are described in Chapter 14, others can be purchased from proprietary sources The inclusion of vitamin D_3 is just as essential with infra-red brooders as with

by the light With this system they can be easily observed and very quickly become accustomed to using the lights for "warming-up" as desired Ease of observation and freshness of air around the chickens are advantages of this type of brooder With half a square foot per chicken, the room is kept singularly free from odours and the chickens should make even, steady growth

Effect of Light Upon Chickens

Some may consider it difficult for the chickens to obtain sleep under a continual bright light and also wonder as to its effect upon them

Tests have been carried out and observations on farms have confirmed the results, which indicate that chickens are not disturbed in any way by the light Some research work has indicated that the infra-red ray has a beneficial effect upon blood flow and resistance to disease Chickens make a faster growth than when under dark brooders, as they eat more feed and also feather rapidly Growth is as fast as in the battery brooder and chickens are hardy when handled correctly in relation to type of shed and feeding They take sleep as they feel inclined and a casual observer might think there are dead chickens under the lamps Quiet observation of the chickens day or night indicates that some are usually taking their turn at sleeping At night in particular it is sometimes possible to find them all sleeping

They will hug the lights fairly closely in the early stages, hence feed and water should be provided in both inside and outside rooms The drying effect of the lights helps keep the litter underneath in good condition and the litter should be stirred and raked around so that it does not pack down When chickens are three to four weeks old the litter may pack a little under the lamps at this stage, necessitating more stirring or removal

Method and Duration of Lamp Use

[a] Variation of number of lamps

Control of the lamps can be achieved by altering the number used A suggested procedure for three lamps is as follows. During the first week (or a day or so longer in cold weather) three lamps should be used day and night for 300 to 350 chickens After this period three lamps are kept on at night, but during the day two lamps only are used During the third and up to the fourth week, two lamps can be used at night and one only kept on by day This method *is* quite sound and has proved efficient If an infra-red lamp set-up has resistance switch for turning lamps to medium and low, all lights can be left on and this method used to gradually wean the chickens Great caution should be exercised with this type, because when the lamps are turned down the actual loss in heating effect is greater than the reduction in light would indicate Thus chickens, on going under the lights for heat, may not get sufficient warmth Under certain conditions this can be a danger, so make it a rule to turn lights down only if quite sure of weather conditions Cutting off the lights must be done gradually—watch the way in which the chickens spread out as a guide.

has been used successfully. Requirements in relation to [illegible] size of shed need to be carefully considered This has possibilities where electric power is unavailable. Such matters as general feeding and control are as set out in the foregoing

HOT WATER PIPE SYSTEM BROODING

Early Type

Hot water pipe heating systems have been used in the poultry industry from the early stages of artificial brooding and large-scale incubation in the 1920s They were very popular in New South Wales with the use of a simple coke-burning boiler working two lines of 2-inch-diameter pipes. The brooder shed was divided into a number of separate runs, and ten or more lots usually of a hundred chickens could be handled in the shed, having the warm portion under the pipes (which were covered by a hover or hinged boards), then an inner cold run and also an outside open run Rearing results were good, but the labour required was heavy owing to the necessity for stoking the boiler at fairly frequent intervals, although if correctly stoked last thing at night it would carry through to morning Of various other systems some had pipes over the chickens on a solid floor, others had pipes passing under the chickens, which were then on a half-inch-mesh wire-netting-covered frame Owing to the labour involved with a comparatively small number of chickens, this system has waned in popularity The use of battery brooders and the infra-red system has become popular, giving efficient results with less attention and capital investment

PRESENT-DAY ADAPTATION

The pipe heating system is not usually adopted on ordinary commercial farms today as used above, but with suitable adaptation is very efficient when a sufficiently large unit is used in order to make the labour attention economical in practice

Mammoth battery-brooder installations holding ten thousand or more chickens are heated by means of large hot water pipe systems, and the cost of heat per chicken is much lower than with some of the present-day types of brooders such as battery brooders holding four hundred chickens per brooder or infra-red units This economy where a very large number of chickens are brooded is made possible owing to the following considerations

1 Maintenance is very light with a correctly installed pipe system supplying heat for up to one hundred brooder units each of one hundred chickens. This is due to the even distribution of heat obtained, whereas a number of individual separate heating units require frequent checking Also one heating unit will serve the whole brooder

2. A hot water system is economical of power once it has reached operating temperature, and this can represent a marked saving in operational costs Also if the source of heat is cut off for any reason the brooder pipes hold heat for a considerable time

battery brooders. Infra-red rays are no substitute for vitamin D_3, so this must be supplied. If a low-protein mash was fed it would lead to toe-picking (and feather-picking) under this system. Also the litter must be kept loose so that the toes of the chickens are not visible as they would be if sand only was used.

Feed consumption is high mainly because of the extra light available, being usually equal to that of chickens in a battery brooder, and more than with ordinary floor brooders. Chickens grow faster as the result of this extra food consumption. It is expected that 115 to 135 pounds of feed will be consumed per one hundred chickens from day-old to four weeks of age, according to energy level of the feed. Chaffed greenfeed can be supplied from four to five days of age. This practice helps keep feed consumption down and acts as a control for some occupational vices.

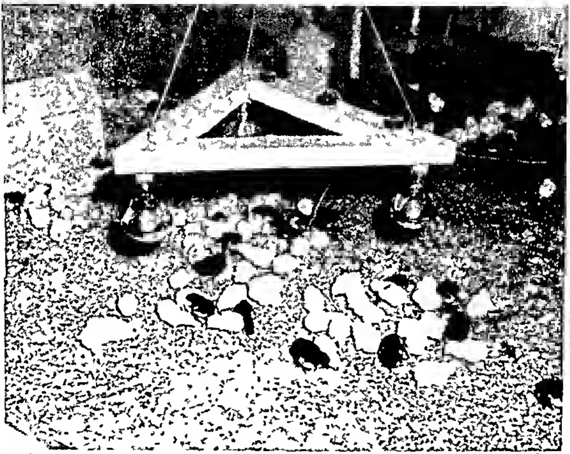


Fig. 72. Infra-red brooding of chickens, using 3 lamps on a triangular frame. The lamps are 17" above the floor (14" to 15" above the litter). A guard is used for 3 to 5 days. Three hundred chickens are handled successfully under 3 lamps, which are of bright-light type to promote feeding, but may also be used with coloured filters.

The foregoing paragraphs indicate the efficiency of infra-red brooding in relation to cost of investment, low rearing mortality and well-grown fast-feathering chickens.

A kerosene-operated brooder referred to as infra-red incorporating the use of a mantle under a small reflector, fed from a fuel tank under pressure,

Handling chickens Place chickens carefully under the brooder when received Carry out this transfer inside the shed to avoid danger of chilling when removing from the chicken box

These points can apply with all types of floor brooders

Observe the reactions of the chickens—they should settle down in a short time with a contented chirruping when under the brooder if it is warm enough, if their notes are shrill and distressed conditions are too cold This also applies at night—when conditions are as they should be in relation to temperature the heads of the majority of the chickens will be just outside the flannel curtain

The waterers should be made available from the start, also feed can be provided (unless chickens were moved directly from the incubator after hatching, if received from the hatchery after sexing and transport they are normally ready to eat) In addition to the two small feeders mentioned spread some paper or cardboard and throw feed over it to promote early feeding Battery mash, in mash or in pelleted form, can be made available from the beginning (Some cracked grain can be thrown about also the first day if desired) Place the feeders so that the light shines on them For the first three or four days the only attention necessary should be to maintain water and feed and stir the litter At the end of this stage remove the guard and the full run of the pen or shed can be given The feeders can then be spread out provide one large waterer, set in a shallow tray of sharp sand—this prevents water spilling on the litter, but is not needed if an automatic waterer is provided Even then, make certain that the litter is not allowed to become damp either as above, or by means of a wire-netting frame against the waterer

When an outside run is provided it can be used by chickens from six to seven days old as weather permits A temporary enclosure for a few days is advisable to prevent chickens straying too far and to accustom them to the shed—particularly if the shed is built on a large area to enable it to be used through all rearing stages

LARGE HOVER BROODER

Electric Type

The electric hover brooder has been used successfully for the rearing of large numbers of chickens It is normally circular in shape and usually has a curtain of flannel at the edge of the hover A hover 4 feet in diameter would be suitable for approximately 300 to 350 chickens and this group size is suggested as best in relation to growth and rearing mortality Another popular type, of similar capacity, is built square and the flat top forms a tray in which sand is placed This aids heat distribution and the chickens use the top area also after a week or so

The usual heating system has been a conical element of the type sometimes used in radiators, or a number of heating coils (as used for heating purposes in some types of battery brooders) Heat successfully supplied has been of 1000-watt capacity for 350 chickens All electric hovers are normally equipped with a control that cuts the current off and on as required to maintain a reasonably steady temperature

3 The principle of several tiers of pipes can be used for present-day brooding Thus there are up to five-tier battery-brooder units with a suitable system of stop cocks in the pipe line—and correct levels in installation—to give adequate control It is usual to have the chickens moved down each week so that by the time they reach the bottom floor (the temperature is lower at each stage) they are "hardened or weaned" off heat

4 The coke burning boiler has proved successful for the hot water pipe system, but in many cases has been converted to either oil fuel or electric power with a great saving of labour in operating

The above are some of the reasons why one of the earliest types of brooders has survived as a very efficient system under present day conditions for use in larger establishments specializing in the sale of month old chickens, or for very large poultry plants for either egg or meat production The field for use is restricted mainly to this sphere, and as this type of brooder is a specialized unit available from proprietary sources, it does not fall within the scope of a general textbook in relation to constructional information

It should be emphasized that the rules for temperature range required, ventilation, sanitation of the brooder, and feeding and watering requirements are as for the battery brooders described earlier in this chapter

FLOOR HOVER BROODERS
SMALL TYPE

Various types of floor brooders are available Small hover brooders are usually of fifty- to one hundred-chicken capacity They can have a hover circular or square, and ordinary small wick burning lamps or electric black or coil elements can be the heating medium Curtains hang at the edge of the hover nearly to ground level to conserve heat Very good results have been obtained by many operators with these brooders

Suitable Shed for One Hundred Chickens

Refer to small shed described for single infra red brooder earlier in this chapter—this is suited in all respects to the small hover brooder

Handling a Small Hover Brooder

Preparation Set brooder in position and fill lamp (to a level below top of container to allow for expansion and prevent fire) having fitted a new wick Run the brooder for a day or so before required as a check Have about 2 or 3 inches of chaffed straw or chaff—or whatever medium is being used as litter Sand or earth only is not advised Have the guard in position—it should be set out about 15 inches from the brooder edge and be about 12 inches in height, and can be of cardboard, bagging on netting, boards (or flat iron) Have two small feeders and two small drinking vessels (which the chickens cannot get into, and arranged so that the litter will not get wet) Check the brooder temperature—90°F to 95°F just inside the curtain about $1\frac{1}{2}$ to 2 inches above the litter is ideal, this will feel pleasantly warm when one's hand is pushed under the curtain

iron circular hover about 18 inches high at the centre and 4 inches at the edge. A baffle plate is usually above the heater at the centre principle used is such that "a hot room" is a description that could be applied. The central heating unit is normally a blue-flame burner that develops considerable heat. Regular attention to filling the lamp is essential. Fill night and morning to be safe. See that sufficient heat is generated for a reading taken just inside the edge of the hover (about 2 inches above the floor) to be 95°F. to 100°F. This means that the chicken can obtain sufficient warmth at the edge of the hover without seeking heat under the brooder. It is important that the effect of fumes be avoided by the safeguard of sufficient temperature. The room is kept very warm and it could be a cause of chills if chickens were to go from this room straight outside to the open. Also there could be danger of a strong wind blowing in through the door in this case, and possibly extinguishing the lamp. (*Note*: The care of the lamp is very important—keep the feed-line level, wick correctly adjusted, and do not overfill the lamp or have the litter right against the lamp. Neglect of these points can cause disaster with fires resulting in possible heavy loss of chickens.) The intermediate or "buffer" room means that the chickens can feed in a normal temperature and can go outside from this room. The outside run provided should be at least 1 square foot per chicken if the chickens are going to be kept up to 4 weeks of age. It can also be used for intensive rearing with no outside run made available. (This is recommended for the intensive farm.)

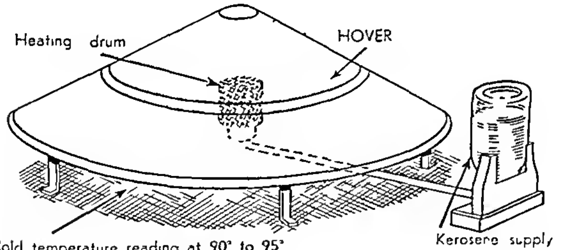


Fig 73 Larger kerosene hover brooder suitable for up to 500 chickens.

An alternate run should be used with this brooder, as with the others, if a second batch is to be run through in the same season. This gives an equal advantage to both lots of chickens.

Adapting a Shed Built for Layers

If the shed is one in which chickens can remain after removal of the brooder, with use of a cold brooder (described later) and then installation of roosts for use as a rearing-shed and later as a laying shed, then it would

Checking of Controls and Capsule

The control, operating on similar lines to that of an incubator or battery brooder, consists of a sealed capsule or capsules sensitive to heat (a mixture of ether and alcohol is usually employed) and these expand and push against a small micro-switch or tilt a mercury glass tube and thus break the circuit. When the brooder cools the capsule flattens and the circuit is opened up again (A smell of ether would indicate a damaged capsule, as in the case of other brooders or an incubator)

The same temperature requirements (90°F to 95°F near the edge of the hover) would apply as for other brooders with normal reduction as the chickens grow (A brooder which is giving satisfactory results, and has the advantages of the electric hover type where power is too costly or unreliable, is the *gas brooder*. The gas is supplied in cylinders Less labour is needed to handle these than kerosene brooders Fumes are not a problem, and a regular temperature is held Handling methods as for other floor brooders) *Feeding* requirements are also the same—the use of a suitable battery feed or mash up to the end of their period in the brooder.* It is also necessary that a guard be used around all these brooders for the first few days (at least 12 inches high, of draught-proof material, and about 18 inches from the edge of the brooder)

Shed

A similar shed to that described for the infra-red brooder can be successfully used Maintain litter requirements as for infra-red brooders Where it is desired to use a laying shed for the first year a similar adaptation can be used as described for the infra-red brooder

Comment

This type of brooder gives good rearing results and is still popular throughout Australia

Kerosene Hover or Colony Brooder

The kerosene hover or colony brooder is efficient for use when electric power is unavailable or unreliable It is a means of cheaply handling a large number of chickens in one batch Skilled operators have handled up to a thousand chickens in one lot, but it is suggested, as for other brooders, that 300 to 350 chickens is a desirable number to handle. The chickens do well under this system and are handled on similar lines to those mentioned for the electric hover and the infra-red, except for one major point. This refers to the use of the inner room, which should be regarded as a necessity with the kerosene-heated hover brooder, and is, of course, highly desirable with the other types also Dimensions of the shed can be as described for the infra-red unit The large kerosene brooder hover has no curtain at the edge The hover usually consists of a galvanized-

* In brooder rooms with these large floor hovers, whether kerosene or electric, try to provide a normal electric light globe, for day use as a general rule This will save many losses by encouraging chickens to feed earlier, and is particularly valuable early in the season These additions are very important

rapid loss of temperature, as the loss of heat is slow when the whole of the floor is warmed. The cost of installation is relatively high with this system also the principle of overhead heating is a more natural one A problem with radiant heating has been too low a humidity in the air affecting body-weight of chickens. In addition overhead heating has the advantage of easier weaning of the chickens from the heating stage The underneath heat principle was also used in battery brooders over twenty-five years ago—some are still in operation. The warm portion of the battery had the normal wire-mesh floor, but the heating was by radiation and convection current from the iron floor heated by a kerosene lamp (as for the small brooder mentioned above).

The cost of running a radiant-heat unit is heavy, but can be economical if the unit is sufficiently large to handle a big number of chickens at the one time. It could be satisfactory for raising grillers for early sale The general preference in the industry has been more towards the other types of brooders described in this chapter (battery brooding and infra-red brooding)

COLD BROODERS

Some poultry-keepers have successfully reared chickens without the use of heat These throw a great deal more work on the person handling the chickens and it is essential that only small lots be handled with this system Fifty chickens in one lot is usually sufficient with an ordinary small cold brooder. The chickens must not be allowed to go very far from the brooder, a surround or guard must be placed so that they cannot move out for more than 12 or 15 inches for the first few days Frequent visits should be made to see that the chickens go under the brooder during the day

A depth of 3 inches of chaff, rice hulls or similar litter material is necessary on the floor Shed size and type can be as for infra-red brooder—see p. 161.

The normal type of cold brooder used in these cases is one that has been in use for many years It consists of a frame 4 inches deep, 30 inches long, and 24 inches wide. It is covered with hessian top and bottom and in between it is packed tightly with straw. This frame stands on four legs, which are adjustable by means of wire pins so that the brooder can be raised as the chickens grow. The brooder is started with the bottom of the frame about 3½ inches from the floor.

The hessian on the bottom of the frame has the necessary flannel attached (If making this brooder sew flannel into position before the hessian is tacked on to the frame)

The flannel should be 3 inches wide and it is sewn in rows 2 inches apart These flannel strips are slit every 2 inches A hessian curtain against the edge of the brooder can be used to keep the chickens under the brooder as required so that they will not stray out at night. Sufficient air will be obtained in the early stages even though the curtain is in place, but not after the first two weeks. Discretion can be used in this respect for hot or cold weather.

The principle of this type of brooder is to conserve body heat by cosy

be used for only the one run of chickens and would save any need for moving chickens at any stage An area at the end of the shed equal to that of the brooder-shed inner room referred to can be enclosed with glass cloth in the front, a temporary division made in the shed, and the balance of the shed used for the inner cold run In a cold area a temporary closing of the half-open portion of the front of this balance of the shed may be advisable for the first few weeks If the shed is large, an area equal to the normal outer brooder shed could be temporarily enclosed

The use of the floor brooder would be followed by the use of a "warm corner" or provision of a cold brooder in the brooder section, and after the young stock reach 6 to 7 weeks they should commence roosting It is possible to eliminate the cold brooder by using heat longer and lowering the temperature gradually until the chickens roost At 5 or 6 weeks roosts can be placed in position above the chickens in the cold brooder (or the floor brooder left in place) and they gradually take to the roosts from there Also providing a small pilot light will be a further precaution against the possibility of panic among the chickens (Suitable cold brooding arrangements are covered in the next chapter)

Coke- and Sawdust-burning Colony Brooders

It is possible to use a coke burner as the central heating unit, and in localities where good sawdust is readily available some prefer to use sawdust burning stoves as the heating medium These have given good results The main deterrent to the use of these systems for a limited number of chickens is that of the labour requirements, as late night and early morning stoking are usually required The kerosene unit does not require refilling during the night All other points in relation to shedding, temperatures, feeding and handling methods would be as for the kerosene hover brooder

RADIANT-HEAT BROODING

The radiant heat method of brooding has been used overseas, and also to some extent in Australia In this system the whole floor is heated and the chickens obtain their warmth from underneath (A similar system has been used in small chicken brooders that had a small kerosene lamp heating the iron floor of the sleeping portion of the brooder The heat was spread out by having a double bottom to the floor consisting of a metal tray just above the lamp This small brooder gave reasonably good results) The usual method of warming the floor with the radiant heat system has been to set up just under floor-level a series of pipes running parallel and then to pour the concrete floor around the pipes The pipes are then heated and the whole floor becomes warmed Another way of heating the floor has been to use electric cables in the floor, which is usually solid, but sand has been used (qualified operatives are required for the installation of this type of floor heating)

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insulated surroundings (Another type of cold brooder—used in India—is a small box lined with bagging over straw Flannel or bagging is hung inside from the hinged roof Ventilation holes are provided, and entry is through a hinged shutter A box 2 feet x 1½ feet x 1½ feet is used for 20 and up to 30 chickens Results are quite successful)

Chickens are more easily reared with heated brooders For general use cold brooders throw too much responsibility upon the operator, but they can be used in special circumstances, *and* in developing areas

WOOD-BURNING BROODER

This type of brooder is not suggested for general adoption in view of labour requirements

It is described to illustrate basic important points in brooding—sufficient warmth, good ventilation and sufficient room. These are embodied in this simple brooder and the results are very good

THE BROODER

The complete brooder consists of a 44-gallon drum sunk into the ground about 15 inches at the centre of the brooder room The floor of concrete is laid around the drum The top of the drum is cut half-open and a hinged lid covers this portion (for draught adjustment and to allow stumps or wood to be put in the drum) A small hole 1½ inches in diameter is made about 2 inches above floor-level in the front with a small piece of tin hinged so that it can close or open this "damper" with a wire as required The brooder is completed by a piece of flue pipe from the top of the drum (the unopened portion) leading up and through the roof with an ordinary flue top

A screen of half-inch-mesh netting about 2 inches out from the drum is made to surround the drum to prevent chickens getting right against it The size of the brooder room is usually about 10 feet by 10 feet with an outer room of the same size A lean-to roof 6 feet 6 inches at front and 5 feet 6 inches at back suffices with an inner division, and half of the front enclosed with glass cloth This will handle 350 to 400 chickens in one batch Sand is placed on the inner floor room and chaff and sand in the outer room The fire is started, and then regulated by means of the small damper and the top lid Labour requirements are fairly heavy, as it is necessary to stoke the fire fairly late at night and again early in the morning Mallee stumps have proved very satisfactory as fuel

REARING RESULTS

Handling of the chickens in relation to feed and water is as for other brooders The inner room is used for a few days before allowing the use of the outer room The heating system is highly efficient, as it not only supplies radiation from a central heating source but also warms the floor for 2 or 3 feet out from the drum (a small radiant-heat system) Chickens normally spread out in a circle about 2 feet from the drum when the fire is burning well and they have no overhead hover at all (as with the infra-red system) Also there are no fumes

Observation in the field has shown that some of the best chickens possible have been reared with this brooder securing even development and a proper standard of rearing

This particular type of brooder may appeal to sideline poultry-farmers in areas where electric power is unavailable and suitable fuel can be obtained—the labour is constant but the results are excellent If the chickens are handled in one lot for the season only three or four weeks of attention are required

Note Ultra-violet lamps have been used to reduce disease and develop extra vitamin D, but with correct conditions they would not appear to give marked gain in open brooder rooms In crowded quarters beneficial results may be obtained, but there is no real substitute for correct husbandry practices with chickens

SUMMARY

1 *Ample warmth* is essential in all brooders

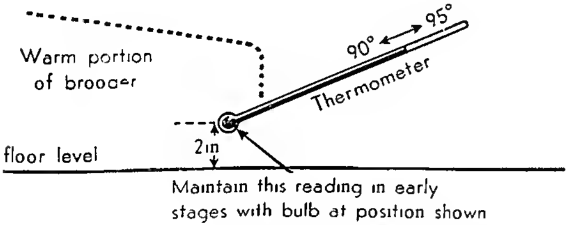

Fig 74 Adequate warmth for brooding so that the chickens spread out

2 *Ample light* in all types of brooders is essential to induce early feeding and save rearing losses Provide artificial light if necessary The feed *must* be close by, easily seen and accessible

3 *Ample space* is necessary to prevent overcrowding, which results in mortality, vices such as picking, feather eating and uneven growth This applies to battery or floor brooders For each square foot of total space allow only 6 chickens on wire and 2 chickens on floor, which includes 24 per square foot in warm portion, for the full 4 week period

4 *Sanitation* must be maintained by keeping litter well stirred and dry with floor brooders or cleaning battery-brooder trays frequently Also good health is maintained by fresh air intake as compared with matted litter or loaded, smelly trays Provide sufficient ventilation Keep litter dry and loose Trays to be cleaned every 2 to 3 days

5 *Prevention of damp patches* in the litter is essential Provision must be made for the overflow around the waterer to be run off or absorbed This is particularly important up to the 8 weeks stage—to help prevent coccidiosis Also provide at least one drinking vessel for every 100 chickens

insulated surroundings. (Another type of cold brooder—used in India—is a small box lined with bagging over straw. Flannel or bagging is hung inside from the hinged roof. Ventilation holes are provided, and entry is through a hinged shutter. A box 2 feet x 1½ feet x 1½ feet is used for 20 and up to 30 chickens. Results are quite successful.)

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	White Leghorns	*Heavy breed and crossbreds*
2 weeks old ..	3 ounces	3 ounces
4 weeks old ..	$6\frac{1}{2}$ ounces	$6\frac{1}{2}$—7 ounces

These figures are only a guide (For cockerels refer to Chapter 18)

Note. Weights will be below these with unbalanced rations fed, and ordinary hover-brooded chickens may weigh less than chickens under infra-red lamps and in battery brooders

12 What brooder to use? The selection of type of brooder from those described in the text will be determined by.

(*a*) Availability of electric power and the likelihood of any interruptions to supply; for example, the battery brooder would be used for wire-cage plants as the logical method of starting chickens, while for raising griller on litter the infra-red or hover brooders (electric, gas or kerosene) would be the choice Electricity would probably be the choice of most where supply was constant and reasonable in cost—otherwise gas or kerosene offers an alternative

(*b*) The number of chickens to be handled—as explained in the text, some brooders are economical for large numbers only, for example, the long pipe line for very large numbers only, but battery brooders for small groups to be handled with low labour needs Infra-red would have a stronger claim for deep litter brooding for medium and large size groups

(*c*) Finance available may determine the type of brooder—infra-red brooders, for example, being cheaper than battery brooders

The majority of the proprietary lines of brooders that are available and are made in Australia by various firms are efficient and economical They will enable maximum rearing results, when situated in the correct size and type of room, and when good husbandry is used with chickens

The popularity of various makes is a good guide in this respect The general standard of these brooders will compare favourably with those in any other country

Note Some of the types of brooders described will serve both for Australia and developing areas A further reminder is also given on the necessity of keeping conditions uniform in relation to feeder and waterer types, also general conditions, when changing to the weaning stage (which is covered in the next chapter)

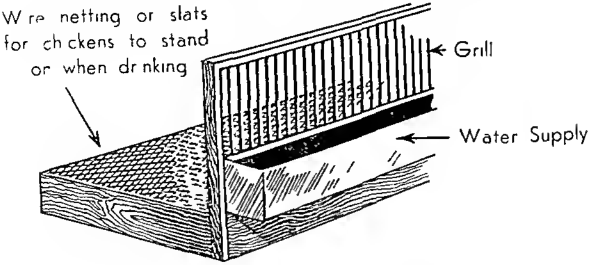


Fig 75 Prevention of damp patches in the litter

6 *Keep the floor level* free from slopes or ledges so that chickens can move from warm to cool area without obstruction during the night if required and have ample width opening—a small 'pop hole' is dangerous in a small brooder

7

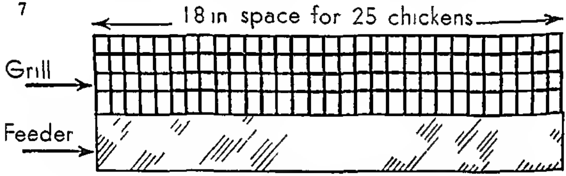


Fig 76 Sufficient length of feeding space is essential Give more space *and* grille openings as chickens grow

8 *Feeding* should be with a chicken mash containing sufficient protein, energy, vitamins A, D_3 and B_2 etc See Chapter 14 for rations

9 *Uniform surroundings and adequate ventilation are necessary* Provide by use of uniform type feeders and waterers, and as chickens grow increase floor space gradually Guard against panics Allow for *adequate* ventilation with windows or louvres so that the air is kept as fresh as possible, also an insulated shed is easier to keep warm in the cooler months

10 *Observe your chickens carefully* Chickens will be spread out when the warmth is correct and they are contented and properly fed Listen for a contented chirrupping—this indicates that all is well A distressed shrill note indicates trouble, either a chicken is lost, or caught up, or chickens are cold or lacking water or feed

11 *Check average growth of pullets* Under good husbandry and with a good ration and sufficient feeding, laying type pullets should weigh approximately as follows (without the use of antibiotics*)

* With the use of antibiotics pullets can weigh 9 ounces at 4 weeks, but this does not assist laying results It can be added when raising pullets for meat sales

are often made that it is "too costly to have sheds standing idle for most of the year" or that "too much area is taken up by the rearing-yards"—and so on. This attitude is the cause of much high mortality and high disease incidence, and also of disappointing laying results in a number of cases. It cannot be too strongly emphasized that the future well-being of laying stock is decided by the rearing environment given, whatever system is adopted for rearing. Ironically enough, the operators who have often proved to be most efficient in this respect are those who operate the poultry unit as a sideline, and not on a commercial basis.

The beneficial results of good conditions are seen in open-range rearing on general farms where young stock can have unlimited range in paddocks or stubble. Field observations of poultry farms have shown, where conditions are ideal—free range with suitable roosting sheds and isolation from old birds—that very satisfactory and efficient results in relation to health and laying have been obtained, even when laying quarters were inferior. The birds had the stamina to "take it". [In view of economic cost, adult mortality (see Chapter 7) must be kept down to approximately 10 per cent to prevent a serious reduction of the returns on a poultry unit.]

A practice outlined by the late James Hadlington in his book *Poultry Farming in New South Wales*, referred to as "the third stage—free range", covered the use of ample-sized roosting sheds well spaced out, and running young stock at the rate of 400 to 500 to the acre with good pasture. This system was used from 12 weeks onwards and for this stage it is just as efficient today as it was then in the early 1930s, and is in line with efficient range practice in this country and overseas.

These comments are given as a basis to range rearing (intensive rearing is covered later) in order to stress the importance of efficient rearing conditions. Also this initial requirement must again be emphasized: use either free-range rearing, or intensive rearing if sufficient area is not available, but not in between—a compromise is not efficient.

SYSTEMS FOR REARING YOUNG STOCK

Various systems that have been proved efficient will be dealt with. Adoption of any one system can be based on the area of the farm, capital available for establishing the poultry unit, and number of stock to be handled. The real efficiency of the rearing system will be decided by the costs involved and routine attention required. An endeavour is made to present a description of systems on this basis.

METHODS OF WEANING FROM HEAT AFTER HOT BROODER STAGE

The basic necessity is to "cushion" chickens in their surroundings after they leave hot brooders at about three and a half to four weeks of age. To move chickens direct from a brooder into a large shed without any covering is to invite disaster under normal weather conditions. This "cushion" is usually in the form of a "cosy corner" with safeguards against smothering. It must be clearly understood (*a*) that if chickens are taken from a brooder (even if the artificial heat in the brooder has been reduced

CHAPTER 11

REARING YOUNG STOCK

THE period between the use of heated brooders for chickens and the housing of pullets in laying-quarters (or between heated brooders and marketing time for cockerels) is commonly known as the rearing period. This can be dealt with in two ways—either by using two separate systems (often referred to as the second and third stages of rearing) to cover the period, or using the one system only with a slight adaptation for the early stages.

Various systems for both free-range and intensive rearing will be described, as many systems work quite satisfactorily. Some of the basic considerations to be kept in mind are:

1. Young stock should be gradually weaned off from heated brooders with suitable conditions and quarters to avoid crowding, and yet be acclimatized to open-shed conditions in a reasonable time. The earlier chickens are weaned from heated conditions after three or four weeks the better. Poor ventilation caused by closing chicken quarters to maintain warmth, and keeping them closed for a long period, will predispose them to disease and give poor rearing results with stunted, unhealthy stock.

2 A system must be adopted that suits the area of the farm Open-range rearing in its full sense, or intensive rearing should be adopted Small sheds in conjunction with small runs will not give good results

3 Young stock must be kept strictly apart from adult stock during this rearing period

4 Correct feeding for the system adopted is necessary. It is very important that ample feeding space be provided to avoid crowding and feather-picking and similar vices See Chapter 14 for feeding rations suited to range or intensive rearing practice

5. The need for provision of a suitable brooder in the early weeks of a pullet's life is understood by nearly all who undertake poultry-keeping; now, the requirements of the balance of the rearing life are equally important, although often neglected. Any set-backs in rearing leave a permanent effect. Good quality in pullets is not achieved just before laying—careful attention is required right through the rearing period. One authority in the United States has listed six to twenty weeks rearing as responsible for 70 per cent of results with layers.

CORRECT REARING FOR LOW MORTALITY AND MAXIMUM EGG YIELD

The basic importance of good separate rearing conditions must be realized by all engaged in or about to engage in poultry-farming. Remarks

to a minimum), the new conditions are nearly always cooler as more room should be provided than in the brooder, and (*b*) that chickens become upset and panic with changed surroundings As a result they may go up into a corner or against a wall (particularly on a cold night) and smothering can cause heavy losses Locking up too late can have the same effect Therefore chickens must be settled down in new surroundings an hour or two before sundown to avoid panic Various practices are adopted to overcome these difficulties This basis also applies for purchased month-old chickens

A safeguard used by some farmers is to move the most forward a few nights earlier This smaller number are shut in the new sleeping quarters. The balance are then moved across and the chickens that have been "in residence" for a few nights act as leaders to the others, thus avoiding the risk of consequent heavy losses A pilot light above the sleeping portion of the shed is strongly recommended as it helps to calm down big lots of chickens, particularly if they come from infra-red brooders If no power is available for a small lamp, a hurricane lantern will serve A light makes it easier to drive them to the sleeping quarters (Also, keep feed ration, and types of feeders and waterers, similar to those in operation before the move It helps chickens in their new and strange quarters)

The requirements of suitable weaning quarters are as follows:

1 Sufficient covering above chickens is required where they are sleeping to keep them warm and thus prevent crowding together, without the need for closing up the whole of the front of the shed Stuffy, ill-ventilated, damp conditions predispose to colds and other complaints

2 It is advisable to have chickens sleeping on a platform or tray covered with wire-netting (half-inch mesh is suitable for month-olds) to prevent the possibility of smothering if they crowd together When the weather is warm some operators have satisfactorily used straw as "bedding" material, as chickens will usually spread out under these conditions

3 A box-like structure can be used inside the shed so that chickens can be closed in before sundown It can sit on the wire-netting-covered frame or be built to have the frame fit inside (see Fig 77 p 185 opposite) Chickens can then be closed in with the certainty that they will be safe for the night (ventilation arrangements for the box with its hessian cover are dealt with later) It is most exasperating and time-wasting to drive chickens on the platform of netting (or slats) only to find a little later that a considerable number have drifted down again This often causes much unnecessary work With the weaning box it is possible to close the chickens in much earlier for a few nights: this does them no harm and saves a great deal of work—and possible losses

WEANING BOX OR COLD BROODER IN THE FIRST THREE OR FOUR WEEKS IN REARING SHED

A type of weaning box that has given excellent results is of simple construction but very effective. For each hundred chickens a box is required consisting of sides only 3 feet long by 3 feet wide and about 15 inches in height. These sides serve as a guard to prevent chickens from moving away from their sleeping quarters once they ar closed in

bad practice to close up the front of a shed containing chickens fo... long—ventilation becomes inadequate. Also provide ventilation at ba...

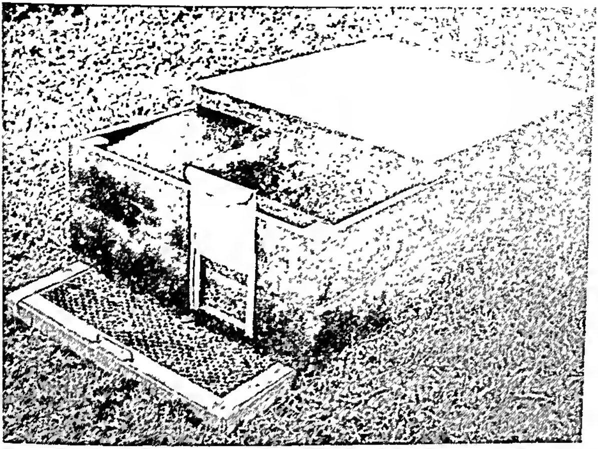


Fig. 79. Weaner or cold brooder box, showing constructional details. Netting frame for floor covered with $\frac{1}{2}$-inch mesh can be seen. Slide opening is usually made larger. Cover fits top and is gradually removed as chickens grow.

THE WEANING PLATFORM

A method that has been used with considerable success in various States is to have two frames about 2 feet 6 inches wide and long enough to go across the rear of the colony shed. These frames can be made of 2-inch by 1-inch timber and covered with netting ($\frac{1}{2}$-inch to $\frac{3}{4}$-inch mesh); 2-inch by 1-inch pieces of timber are nailed on over the frame to form miniature roosts about 4 inches apart. One frame is set up so that it is about 9 or 12 inches above the floor of the shed and is set level. The other frame is used as a ramp from the edge down to floor-level. Bagging should be then draped over the shed roosts to form a box-like canopy nearly the width of the upper frame and hanging down to within nearly 2 inches of the front. (One inch mesh is suitable with 6 to 7 week old chickens.)

To keep chickens from drifting down the ramp an extra netting frame 9 or 12 inches wide to fit across the shed will be well worth while to bring about a control on the lines of the weaning box. Alternatively, the front frame forming the ramp can be hinged to allow it to be raised (needed for 3 or 4 nights only) and lowered again after chickens have settled down.

The canopy should be tacked in position—heavy losses could result if it fell on chickens. (For details of platform see Fig. 80.)

The front of the shed should be closed in for the early period—two

very early.) A check must be made for a few nights following this period to see that the chickens have gone in the box, or smothering will occur if they decide to "go up" in a corner of the shed.

If the shed is a large one then for the first five or six days have a temporary division—this restricts the area and makes "locking up" much easier. These points are worth while—chasing chickens in a large shed to close them in is difficult.

After about ten days with cold conditions, or five or six days under warm conditions, the covering lid can be eased back for additional ventilation. When chickens have been using the box for about two weeks the lid should be pulled along far enough for the opening at the top to allow them to go through as desired, and it can be completely removed a week later—on the assumption that chickens come from the brooder at about three and a half to four weeks of age. Chickens will gradually go up on the roosts, which should be in place just above the box; leave the box sides until the majority have taken to roosting. They will normally return to this position each night. This system ensures easy control of chickens—safe locking up and a good method of training chickens to roost.

Work is carried out at an absolute minimum of cost, and direct transfer to rearing or colony sheds effects economy by eliminating an intermediate system of sheds to wean chickens from heat. Furthermore, intermediate sheds usually have only a restricted yard, which means possible trouble if they are used for a second lot of chickens in a season.

Under cold, wintry conditions, particularly with driving rain, the front of the shed can be nearly closed up for a week or so, but no longer. It is

Fig. 78. Weaner or cold brooder box in position under roosts in a rearing shed. Hessian cover has been taken off, for the chickens have started to roost. Wire-netting frame can be seen through entry hole. Normally used for chickens from 3½ or 4 weeks to 6 or 7 weeks of age.

BATTERY WEANERS OR "FOLLOW-ON" BROODERS

Many operators use what is in effect a battery brooder of increased size to "follow on" the battery-brooder stage (See Fig 81 p 190) This is usually worked in the same room as the battery brooder or brooders to take advantage of the warmth there The end of the weaner should be covered with bagging for a few days to "cushion" the change from the battery brooder (Some battery brooders have enough headroom to leave the chickens in with reduced numbers for this stage with heating unit removed or heat cut off, thus saving a "follow on" brooder)

Feeding is the same as for the battery brooder and chickens are usually held until six or seven weeks of age—some operators hold a little longer Floor space needs to be approximately double that of the first stage battery brooder, i e , one third of a square foot per bird Many overseas operators, to avoid handling, start the chickens at day-old with this space thus giving ideal conditions and ample space (This type of unit is used by many "griller" or "broiler" raisers, when birds are being sold at an early stage and, at a half square foot per griller, can be held to 11 weeks)

This system reduces labour and is often favoured in cold districts, but when chickens are transferred to the rearing-sheds care should still be taken to cushion the shock to some extent A bagging covered frame over the roosts in the shed is advisable for a few nights, also the wire netting-covered frame beneath Treat as for chickens moved at four weeks of age

One important point in connection with this system is that the chickens are "soft" when moved out Many veterinary authorities agree that these chickens are much more likely to contract coccidiosis than chickens moved down to the ground at an earlier stage and thus given a better chance of acquiring immunity When this system is used make sure that the ground to which they are moved has been spelled since the previous year (and if possible—at least occasionally—for two years), and that the shed conditions are dry and sanitary to minimize this danger

The experience of the operator will be a big factor in handling this system In general, use of the weaning boxes or platforms will follow the ordinary battery-brooder stage with very good results, and where precautions are taken and correct feeding used many operators have very good results with pullets, as with "broilers", in the follow on brooder

SMALL PORTABLE SHED AS WEANING UNIT

Formerly used in South Australia, this system utilizes a weaning shed small enough to be moved to fresh ground and thus prevent one of the disabilities associated with fixed run weaning sheds The principle of the cosy corner is embodied, plus a small portion under cover for feeding A small portable run is attached and when a patch of ground is worked out the complete unit is moved a few feet to operate on fresh ground Chickens spend three or four weeks in these weaning units and are then ready for the colony or rearing shed They fill in the period between three and a half to four weeks of age, when heated conditions are normally dispensed with, and the seven-weeks stage They involve considerable

weeks should be sufficient under normal conditions. In hot weather this time could be reduced and under cold, wintry conditions extended for another week. It is necessary that this closing-up should not be overdone. Once young stock are up on the roosts the front should be at least half open. In general the colony sheds can be closed up to a height of about 2 feet in front and an opening of 6 to 9 inches left under the roof at the back—to be closed or open as needed. This provision for ventilation is vital for good health in young stock. Successful results are obtained with shed fronts covered by wire-netting only, but this practice is recommended only for areas where mild winter conditions are experienced, or adequate natural shelter and suitable windbreaks are available.

Strong winds are not liked by young stock (or laying birds) and on windy, wet days the windbreak is appreciated. (Arrangements should also be made for adequate windbreaks in the colony runs.) The use of a small "pop hole" in the front of the shed is advised for such weather. This can be about 8 inches in diameter with the lower edge 5 or 6 inches from the ground. If the door is opened wide in windy weather there is not much protection, but this can be kept closed and the young stock can use the "pop hole". These are also very handy when desiring to count stock by running them through the hole or for passing stock out from inside the shed for any treatment desired—such as deworming or vaccination. (Closing up stock at night and doing this type of work in the morning saves time and labour.) If the door only is used young stock will slip out and may be missed. For this purpose some operators also provide a small hinged door about 12 inches square in the netting higher up in the front. These little extras greatly facilitate general handling operations.

A check at night around rearing-sheds pays dividends in giving information on overcrowding or possible respiratory troubles present in a flock; also to close in stock only means locking the door, as they are on the roosts at night.

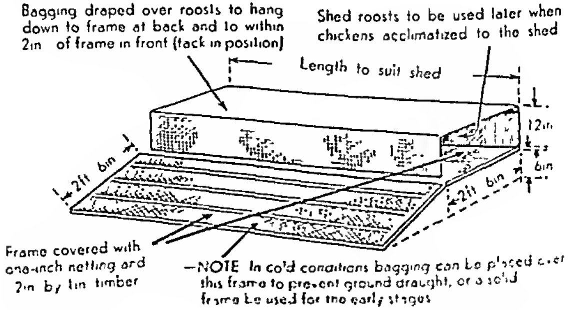


Fig. 80. Weaning platform that can be used at the rear (or side) of a colony shed.

12 inches from the floor This is protected from the weather by a small overhang made of the timber taken from the opening of 2 feet 9 inches by 1 foot

The floor is covered by two frames made to fit loosely in each compartment These are of 2-inch by $1\frac{1}{2}$-inch timber with a central cross piece and covered with $\frac{1}{2}$-inch-mesh netting A strip of tin about 1 inch wide nailed on the top edge over the netting prolongs the life of the frame, the box uprights are outside the box to enable the frames to fit

The sleeping compartment is completed by the provision of a light frame of $1\frac{1}{2}$-inch by 1-inch softwood covered with hessian This is held in position by means of blocks or stops so that it is 12 inches above the wooden floor This frame should not be a tight fit The provision of the frame is very important, as it must be in place for a few days after the chickens are moved in (under normal conditions) When conditions are wintry and cold this frame can be left in for ten to fourteen days, but in reasonable weather it can be removed after six or seven days Under hot conditions late in the season it may not be necessary to use this cover The best guide is to check how the chickens are spread out (a torch held close to and run over the hessian frame will show the chickens under the cover without disturbing them by lifting the cover) Condensation under the lid usually indicates that more ventilation is necessary All rearing units as a general rule face north, but if desired the portable unit can be turned away from any quarter where bad weather is experienced The attached run (which can be a gable structure or three hurdles 3 feet high to form a yard 10 to 12 feet long by 6 feet wide, a fourth hurdle makes the roof) should have two or three bags tacked on the side against the windy quarter A sheet of iron to form a 2-foot veranda against the unit is helpful on the top hurdle for shade and protection It also gives shade for the water supply It is difficult to have automatic watering with these

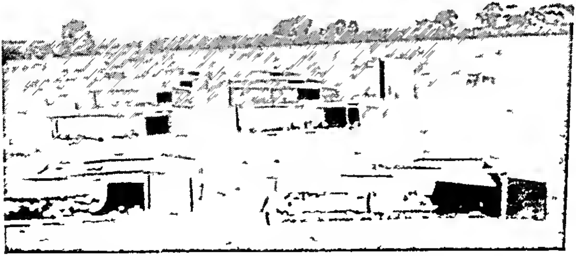


Fig 82 Portable weaning units in operation These can be an intermediate stage between heated brooders and rearing sheds Intended for level areas, for they require considerable labour in moving to fresh ground once or twice weekly

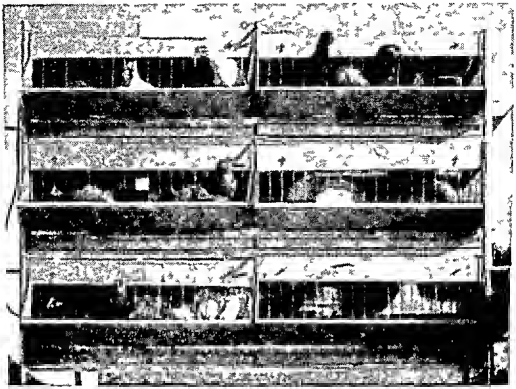


Fig. 81. Weaner or follow-on brooder used indoors. This is without heat, and double the battery brooder space is allowed. Usually accommodates chickens from 3½ or 4 weeks to 6 or 7 weeks of age.

labour because of the frequent moves needed, and the weaning box (see pp. 184-7) has become the popular choice.

DETAILS AND HANDLING OF PORTABLE OUTSIDE WEANING UNIT

The overall size of the unit is 5 feet 10 inches long by 2 feet 6 inches wide. Height in front is 2 feet 6 inches and at back 2 feet. The maximum capacity can be rated as 75 chickens for the period of three weeks. The roof is made of a sheet of 72-inch by 36-inch galvanized flat iron nailed on a frame of 2-inch by 2-inch softwood with a central cross piece. This is hinged to the front of the unit so that the whole roof can swing up to permit cleaning, filling the feed hopper, or general attention to chickens. Sides and floor are constructed of flooring boards or packing-case material. The sides should be windproof and a coating of paint or oil is advised as a preservative. The floor should have two pieces of 3-inch by 3-inch jarrah or other hardwood underneath to serve as "runners" for moving to fresh ground.

The unit is divided into two sections by an inside partition constructed so that it can be lifted out when desired. This partition is 2 feet high front and back. There is an opening 6 inches high by 12 inches long (lower edge 3 inches above floor-level) to allow passage of chickens.

The inner portion of the unit used as sleeping quarters is 2 feet 6 inches by 2 feet 6 inches, as the partition is placed so that nearly 3 feet by 2 feet 6 inches is available for the feeding compartment. The front of the feeding compartment is half open with a gap of 2 feet 9 inches by 1 foot, starting

After this they should go in of their own accord, but it is necessary to check up before sundown to see that they have gone inside if they sit in the outer compartment on a cold night chills and losses will result A slide that fits over the 6-inch by 12-inch opening in the partition is used for the first few nights

The chickens should under normal conditions be allowed the use of the outer run only for an hour or so the first day or two if they have come from a battery brooder, and the period gradually extended to a full day after three or four days Where chickens have come from a floor brooder with an outside run attached they will be quite used to the outer run and should not need any special attention in this respect

COSTS FOR WEANING STAGE

The cost of intermediate weaning arrangements (for purchased month-old chickens or after warm brooder stage) will be the governing factor for many people It should not be necessary to provide specially built sheds for this in-between stage Costs are high and owing to the use of fixed yards by more than one batch of chickens, it is not possible to give the second or third "runs" of chickens the same chance of good growth

The use of the "sleeping box" or the weaning platform for intensive rearing quarters or in the large laying-pen (if being used to raise chickens) or in a colony shed where range rearing is adopted, will be much more economical and is recommended as labour-saving and efficient This can follow the ordinary brooder or the "weaner follow-on unit"

The portable weaning unit is inexpensive but requires more labour This system can be used where land is level and reasonable in cost

RANGE REARING FROM WEANING STAGE TO LAYING PERIOD

With some of the systems previously referred to, merely continue using quarters into which chickens were moved from the brooder The only alteration required is the removal of the weaning box or platform used in the first period, if a colony shed or a future laying-shed has been used This is regarded as efficient practice, because the fewer moves made with chickens the greater the saving of labour With these systems it is necessary to move only twice—once from the brooder to the range shed and thence to the laying quarters, or if a future laying-shed is used there is only the one move after the brooder In some cases, when the brooding is carried out in an adapted laying-shed, chickens commence in the same shed that covers their rearing and laying periods Rearing sheds for this stage can be simple a water-proof roof, roosting space and ventilation, feeding and watering arrangements, in conjunction with ample range

COLONY SHED. IMPORTANCE OF SUFFICIENT REARING AREA

The colony shed referred to previously as having been described in *Poultry Farming in New South Wales* by the late James Hadlington, has given excellent results as roosting quarters for young stock on ample

portable units hence water-troughs or fountains are necessary. These must be of sufficient size to obviate any danger of the chickens "running dry", which can have serious consequences. Feed is usually supplied by a dry-mash hopper inside the box set against the side—filled by opening the lid of the unit (refer to Chapter 14 for feeding rations). The unit should be moved at least twice weekly to fresh ground to give the best results and safeguard against coccidiosis. Efficiency of this unit depends on the use of fresh ground. Where the surface is hilly it may be difficult to work this system unless a single unit is set in a fairly large yard (equal to the area of six or seven moves, i.e. 50 to 60 square yards).

CARING FOR CHICKENS

It is normal to move chickens in towards nightfall so that they have a good feed, and they can then be closed into the sleeping section. It is important that chickens be closed in early for the first three or four nights.

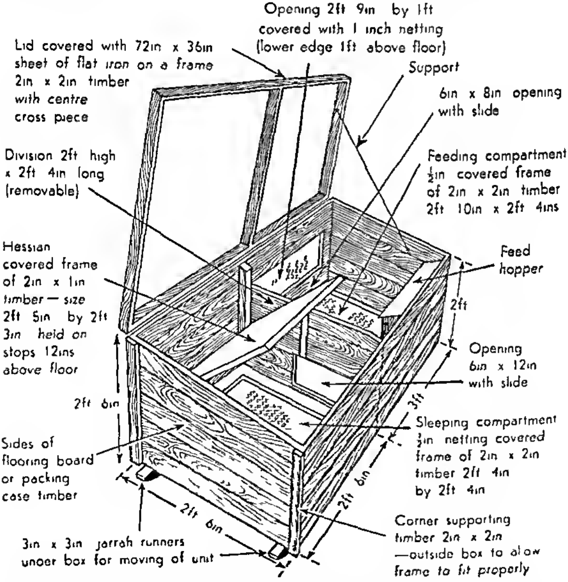


Fig. 83. Portable outside weaning unit, suitable for 75 chickens from 3½ to 4 weeks.

method takes advantage of the locality instinct of poultry ("chickens come home to roost") and young stock will go to their own shed provided that this initial precaution is taken Also have an automatic waterer near each shed if possible

Feeding at one end of an enclosure will make them drift towards that

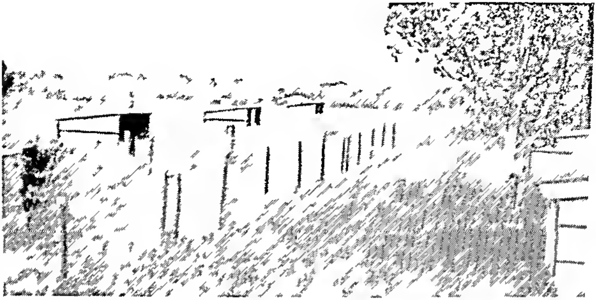


Fig 85 Well laid out colony rearing sheds each 12 x 6 One batch of chickens can be seen being trained to the shed by means of temporary hurdles used for the first week out from the brooder Quarters are well isolated from laying birds and are spelled between use for each spring season On the right is desirable shade

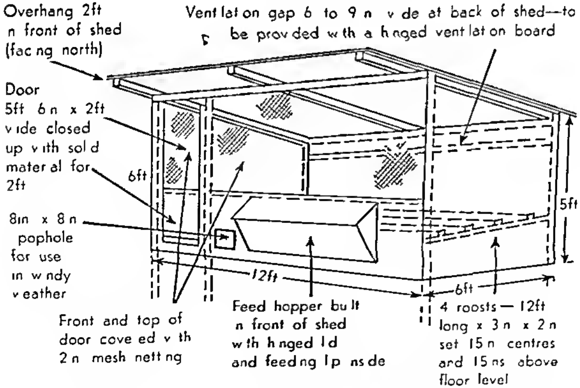


Fig 86 A colony rearing shed **12 x 6** with a height of 6 in front and 5 at back

range. The house described is 12 feet long by 6 feet wide, 6 feet high in front and 5 feet high at back. Two roosts are included, giving 24 feet of roosting space and the recommendation was for fifty pullets. Size is more than ample to carry the birds to adult stage.

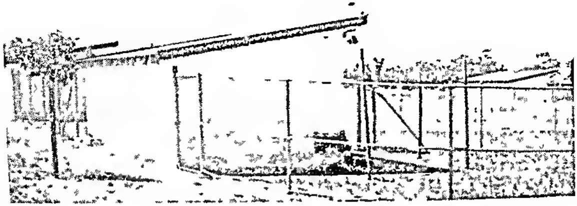


Fig. 84. Well-built, large-colony rearing sheds with ample range. The stocking rate should not exceed 400 to 500 per acre.

These sheds are used with ample range to ensure that land is not overstocked and will never assume a completely bare and "worked out" appearance. Good pasture is not necessarily very high grasses—chickens are better with a thick, short pasture. A few sheep have often been used to keep the grass short before use by chickens. Mowing can be carried out also. Others have reported success with undisturbed growth in medium-rainfall areas. Excessive shade with trees that do not lose leaves in the winter is undesirable, and the land should be well drained. These precautions assist in preventing troubles such as coccidiosis, worm infestation, and so on.

The more heavily the given area is stocked the greater the chance of disease. The maximum per acre should be only four and up to five hundred young stock. This ratio applies for a single yard to each shed, or for several sheds on a large range. Where area is limited and reasonable pasture is maintained (with a six-month spell of the area) up to nine hundred have been run on one acre. It is strongly recommended that sufficient range be planned to spell a portion of the area for a season periodically, so that a considerable portion (half if possible), of the range is used only once in two years. This is common practice overseas. Spread sheds out about a chain apart when used in a large enclosure and do not place close to boundary fences—keep at least 18 feet away. Young stock will use houses as a "stepping stone" to fly over the fence if set too close. With single yards efficient working requires a roadway at least 10 feet wide through the centre of the yards. The extra fence needed will pay dividends in labour saved in handling stock and feed.

It is practicable to have a number of houses in a large enclosure, provided that young stock are trained by being fed at each house and by being kept for five to seven days in a small enclosure attached to it. This

method takes advantage of the locality instinct of poultry ("chickens come home to roost") and young stock will go to their own shed provided that this initial precaution is taken. Also have an automatic waterer near each shed if possible.

Feeding at one end of an enclosure will make them drift towards that

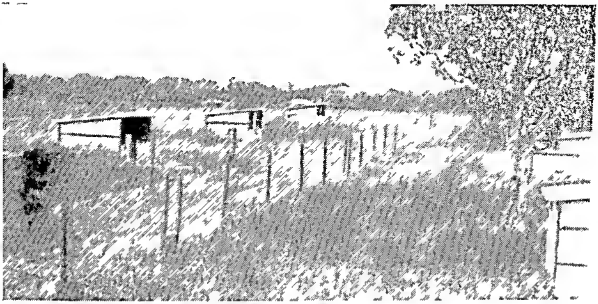


Fig 85 Well-laid out colony rearing sheds each 12 x 6 One batch of chickens can be seen being trained to the shed by means of temporary hurdles used for the first week out from the brooder Quarters are well isolated from laying birds and are spelled between use for each spring season On the right is desirable shade

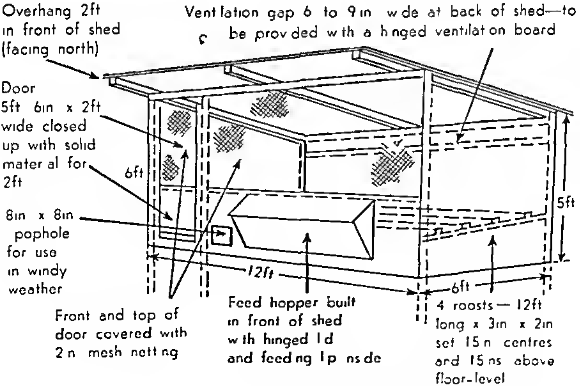


Fig 86. A colony rearing shed 12′ x 6′ with a height of 6′ in front and 5′ at back.

end It is necessary to feed at each shed whether wet mash or dry mash is used Chickens are more contented, and spread out evenly, when on all mash feed available as free choice

Many operators have used these sheds for holding one hundred and fifty chickens in the early stages, gradually reducing to one hundred by the time they are three quarters grown It is preferable to start with only one hundred chickens if possible, as the breaking down of numbers is frequently delayed (This would mean the use of a 3-foot by 3-foot weaning box as described previously for 100 young stock)

A feature that should be included in both this colony shed and the rearing shed described later, is a built in dry feed hopper in the front of the shed This can be filled from outside Building the hopper into the shed front in this way prevents loss of floor space The feeding lip is set inside the shed to facilitate feeding in all weathers This also helps train the birds to remain at each house Alternatively, use a hanging hopper

SMALL PORTABLE COLONY HOUSE

A small tent like colony house for chickens after the hot brooder stage has been used in Victoria, being referred to in the bulletin on poultry-farming issued by the Department of Agriculture The results have been quite satisfactory when chickens were not overcrowded The structure is very light and can be easily moved about It is made of 2 inch by 1-inch timber with wire netting supporting the rubberoid covering Dimensions are 6 feet long, 5 feet wide, 4 feet high to the gable top, built tent-shape A wire-netting covered frame of 2-inch by 1-inch timber is used as the floor to prevent smothering Two roosts 6 feet long are used and forty to fifty chickens can be accommodated up to fifteen weeks and should then be broken down in numbers to reach twenty-five to thirty near laying stage This has been used in orchards and on range Some have covered the sides with flat galvanized iron as a more permanent type of covering

Recommendations on proportion of land to be used are as for the other systems (Ordinary type sheds are easier to service, and cooler in hot weather)

REARING SHED

An adaptation of the colony shed known as a rearing shed has been used in South Australia The adaptation has been on the lines of reducing the floor space of the shed by utilizing the battery-brooder principle of a wire netting floor, and the shed used for a hundred chickens in the early stages is 8 feet long and 6 feet wide

The numbers are reduced as the pullets grow until they are finally brought down to sixty birds per shed by the time they are sixteen weeks old This spreading out can be brought about by moving the most forward of the early stock to adult quarters cleared by the culling of adult stock, or by having extra sheds available If it can be arranged it is much better to start the shed with the reduced number of stock, e g sixty to seventy to avoid the need for breaking down the numbers The growth of the young pullets is much better under these conditions, and fewer problems arise

The maximum number of stock per acre should be on a comparable

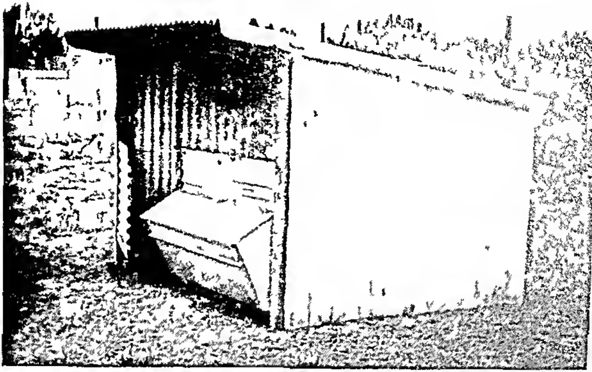


Fig 87 Portable type rearing shed The built in dry feed hopper in front of the shed saves considerable labour, and the birds feed from inside This type of shed is cooler, also easier to service than type in Fig 88

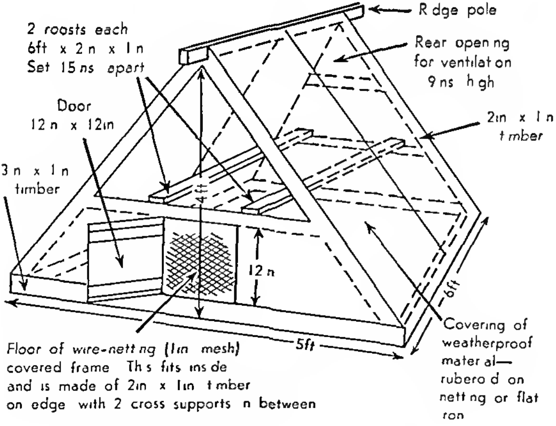


Fig 88 Small, portable tent shaped colony house

basis with the colony sheds. It is vital with all these systems that the land be used exclusively for young growing stock—adult stock should not be allowed on the area at any time of the year. If possible allow periodical spelling of the land longer than between successive seasons only.

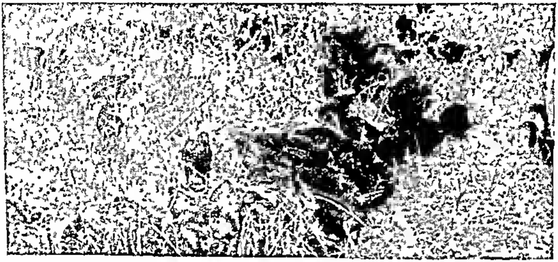


Fig. 89. Well-grown Australorp pullets on range, showing the effect of ideal surroundings. Conditions such as these are a necessary part of good husbandry practice.

FEATURES OF REARING SHED

The shed is 8 feet long and 6 feet wide, 5 feet 6 inches high in front and 4 feet 6 inches high at the back. A space is left under the roof at the rear of the shed 4 inches wide. This could be increased to 6 or 8 inches in hot areas. (See *Fig. 87* and *Fig. 90* for further details.)

The front is closed up half-way and the balance filled in with netting. The distinctive feature of the shed is the use of a floor frame covered with 1-inch-mesh wire-netting. The shed is constructed with posts outside so that the frame will fit over the entire floor. A gap of 3½ inches is left in the front and the frame (of 3-inch by 2-inch timber) can be taken out for cleaning, or when it is desired to use the shed for early brooding.

The frame is carried on the bottom side rails of the shed.

Some poultrymen have departed from this system by using the 3-foot by 3-foot sleeping box from the three- or four-weeks stage onwards in this shed without the wire-netting-covered frame—and with satisfactory results, i.e. on the lines described for the colony shed. Others have adopted the idea of a fixed floor frame (to save material) with a portable shed that can be moved to fresh ground and the accumulated manure then disposed of.

These portable rearing sheds are very suitable in orchards.

The frame is used for promoting cleanliness, and, as it covers the whole floor, it obviates danger of smothering. Also, as the roosts are close to the wire-netting, no training for roosting is required and the floor is dry for the chickens. The four roosts for the shed set 15 inches apart are supported 9 inches above the netting. A temporary enclosure in front of the shed for five or six days is used to train the birds so that they know their own shed. This applies when there is a yard for each shed, or when there are several sheds in one large enclosure.

YARDS FOR REARING SHEDS

Yards or enclosures for rearing sheds or for colony houses need not differ in any way. The question is one of area available. Some operators employ free range for this purpose without any boundary fences. This question is in many cases bound up with the danger of foxes. For normal requirements the area is well protected by means of a high fence (7 to 8 feet) with the netting well in the ground. When a large area is provided, 6-foot fences have been used with success. Individual yards save the possibility of the young stock "drifting", but several sheds in an enclosure allow the stock to use a greater area and save posts and netting.

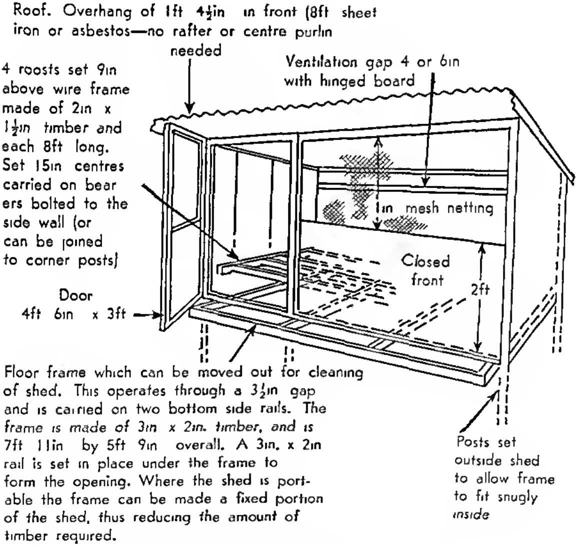


Fig. 90. Rearing shed 8′ x 6′, with a height of 5′ 6″ in front and 4′ 6″ at back.

FOXES

Foxes are responsible for heavy losses of poultry in many parts of Australia. Sound fences give a good measure of protection, though in some cases these are ineffective, usually because of insufficient depth in the ground—allowing a fox to dig underneath—or because a hole is left

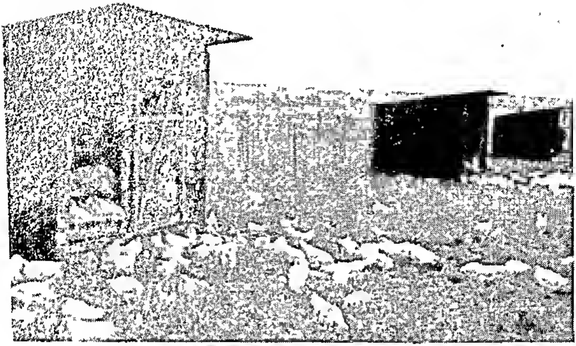


Fig. 91. White Leghorn pullets on range. Heavy culling should not be needed under ideal range conditions such as these.

in the netting that a fox can squeeze through or enlarge. Posts should be placed inside the netting as an extra precaution.

Trapping and bait-laying have been used with success to kill foxes. Another effective method of dealing with them consists in hanging lights along a fence, outside which dogs can patrol considerable distances with their chains sliding along good lengths of wire. The electric fence wire is also reported to have been successful when arranged with one wire about 5 or 6 inches from the ground. Some have used two wires with considerable success—one at about 5 inches, the other about 12 inches from the ground, these being placed just outside the ordinary netting fence. It has also been reported from overseas that where the stock use a small pop hole to enter the shed a grille something like a small sheep or cattle ramp has been used to prevent foxes entering a shed. This would not deal with the danger of young stock leaving the shed early in the morning, which can be quite a danger period with foxes.

Where sheds are set out on range without fences it may be necessary to lock the doors or close the slides after dark and let the poultry out early in the morning (failing the provision of lights or dogs on guard). Precautions should be taken in this respect, as heavy losses can occur with young stock, playing havoc with farm replacement programmes and sending up costs.

HUSBANDRY NEEDS FOR YOUNG STOCK

CULLING GROWING STOCK

It must be made a rule in rearing young stock to cull any backward pullets that show up in spite of proper rearing conditions—correct feeding,

ample space, deworming routine, control of coccidiosis Backward chickens (such as those still "with down and looking about a week old at the four-weeks stage) are not worth persisting with The early loss is the best loss with this type of chicken With most stock the percentage of culls should be low where the above conditions have prevailed Many may be reluctant to enforce a culling policy because of day old purchase price plus cost of feed, but it can mean even heavier losses during the laying year if a "dud" is carried

Adult culling is dealt with elsewhere, but it should be kept in mind that from day old stage right through to the end of the normal laying period culls cost money and one should always be on the lookout culling reduces costs in the long run Also, avoid extra culls by not mixing various groups in laying sheds—always bring flocks reared together into pens together and have them as even in growth as possible This is important in avoiding bullying and fighting among birds

DISEASE PREVENTION WITH YOUNG STOCK

References have been made elsewhere to disease prevention but a reminder at this stage may not be amiss Ample rearing space and good nutrition are the basic disease preventive measures, but in addition keep it well in mind

(*a*) to purchase stock from blood tested lines of good breeding back ground,

(*b*) to control coccidiosis by dry conditions and good husbandry (and do not forget the value of milk products) If an outbreak should occur make immediate use of control methods with recommended drugs,

(*c*) to guard against worm infestation by individual or flock treatment,

(*d*) to avail yourself of preventive measures such as fowl pox and tick vaccination (*and* in developing areas for Raniket or Newcastle disease also)

SEPARATE REARING OF PULLETS AND COCKERELS

In the early stages unsexed chickens may be brooded if it is not convenient to segregate them when rearing breeding cockerels Table cockerels should be reared apart if possible, as they require different treatment and feeding (This benefits broilers also) Where the two sexes are brooded together they should be separated as soon as they can be 'picked out' if not already toe punched or banded for identification The growth for both laying pullets and table cockerels will be better as a result

RECOGNITION OF COCKERELS AMONG GROWING STOCK

On some sideline units mixed chickens may be purchased and raised on the principle of having some cockerels for market as well as rearing replacement pullets A few hints that may assist sideline producers in distinguishing cockerels as soon as possible are as follows

(*a*) Body development will be bigger with cockerels—noticeable with White Leghorns in the vicinity of four weeks, and with heavy breeds a few weeks later (Battery reared stock will show up earlier)

(*b*) Comb will be prominent on cockerels by four weeks in White Leghorns but some weeks later in heavy breeds

(*c*) Leg colour will be a means of identification at a reasonable early stage with crossbreds from Australorp male and White Leghorn hens Pullets have black legs, and cockerels have clear legs This does not apply with the reverse cross, in which both sexes have clear legs

(*d*) Feathers on the back (or saddle) of White Leghorns, Australorps, Rhode Island Reds and so on will be a reliable guide Pullets have an even colour right over the back, but cockerels have feathers with a lacing or shiny bright edges on the feathers running in line with the backbone Some of the heavy breeds are difficult to pick even at twelve weeks old, but this is an excellent guide (White Leghorns are comparatively easy to pick at any time after four weeks)

(*e*) These characteristics do not apply to auto sexed breeds such as Legbars or to the sex linkage obtained when crossing, for example, Rhode Island Red males with Sussex hens Cockerels are readily distinguished at day old In the case of Legbars pullets have a dark brown line down the back as with emu chicks and cockerels have a down something like that of a grey rabbit In the case of the sex linkage with Rhode Island Red males and Sussex hens, pullets are red and cockerels white at day-old—the reverse cross does not give this result

These signs will serve as a guide to beginners In general it is advised that the sexes should be reared separately, if day old sexing is available, or separated as soon as it is possible to distinguish them, as under (*a*) to (*d*)

FEED CONSUMPTION AND REARING COST OF PULLETS

The amount of feed consumed in rearing pullets is a very important question For a person starting poultry-keeping high feed prices mean a very considerable outlay before any returns commence, as detailed in Chapter 3

Approximately 1 ton to 1¼ tons of feedstuffs are needed to raise a hundred pullets to laying stage and at 2c per lb for feed ($1 50 per 60 lb of grain or $50 per ton for mash) this is 50c to 62c per head for the 20 to 25 lb of feed used This is in addition to day old purchase cost, brooding charges and any mortality debit due to losses in rearing (see Chapter 3, Chapter 8 for mortality debit) With good rearing results, these costs would be approximately 40c per pullet, and in conjunction with feed costs total 90c to $1 02 per pullet

For calculating progressive costs, particularly on a sideline unit, needing careful watching of the amount of outlay over the full period of rearing, the following table is given

TABLE 8

ESTIMATED AVERAGE CONSUMPTION OF FEED FOR ONE HUNDRED PULLETS TO LAYING STAGE

	Weight of feed		*Cost of feed at 2c per lb*	
	For period	*Progressive totals*	*For period*	*Progressive totals*
Day old to 3 weeks	100 lb	100 lb to 3 weeks	$2 50	$2 50
3 weeks to 6 weeks	200 lb	300 lb to 6 weeks	$5 00	$7 50
6 weeks to 12 weeks	500 lb	800 lb to 12 weeks	$12 50	$20 00
12 weeks to 18 weeks	650 lb	1450 lb to 18 weeks	$16 25	$36 25
18 weeks to 24 weeks	800 lb	2250 lb to 24 weeks	$20 00	$56 25

Adjust for lower or higher cost per pound of feed

Battery or infra red brooded chickens will eat more in the early stages than ordinary floor brooder chickens Heavy breeds will consume more than light breeds, and intensively reared stock may eat 10 to 20 per cent more than pullets reared on ample open range, according to type of feed

Table 8 shows a feed consumption of 22½ lb per pullet to laying stage This figure, as mentioned above, is only an average Consumption can be reduced on ample range,* and is also governed by the protein and energy content of the feed An average ready reckoner for lb of feed used to laying stage is pullet body weight multiplied by 3½ and add 5½

ASCERTAINING GROWTH RATE OF PULLETS

Careful operators wish to know whether young pullets are growing satisfactorily The main points to note are that the pullets appear active, tight feathered, and healthy (Checking the odd cockerel among pullets for worm burden when killed can pay as a 'stitch in time') A periodical check on the weight of growing birds can pay Weights for chickens up to four weeks were given in Chapter 10 An approximate guide for minimum weights of growing pullets is given in Table 9

These weights will be influenced by method of rearing (intensively reared or range reared), diet (high or low protein ration), and size of strain (small- or large framed birds) Crossbreds can be expected to grow

* When rearing on good, well grassed range in some areas in the United States a system of a restricted feed programme is used and pasture consumption increased by allowing 12 lb maximum feed per day per 100 pullets from 6 to 20 weeks The figures given in the chart are approximately 14 lb per day per 100 for this period The object of the restricted programme is to prevent early maturity and so that pullets in early maturing lines will not lay until about 6 months of age

faster and be heavier in the first twelve weeks than pure breds These comments apply for ordinary systems (Air-conditioned houses, with rearing on set periods of light, are not suggested for Australian conditions with high temperature levels, as an economic proposition)

TABLE 9

AGE AND AVERAGE WEIGHT OF PULLETS

Age in weeks	*White Leghorns*	*Australorps and Crossbreds*
8	1 lb 2 oz	1 lb 8 oz
12	1 lb 13 oz	2 lb 5 oz
16	2 lb 6 oz	3 lb 2 oz
20	2 lb 15 oz	3 lb 12 oz
24	3 lb 4 oz	4 lb 2 oz

NORMAL REARING LOSSES AND THEIR EFFECT UPON COSTS

Detailed reference is made in Chapter 7 to the economic effect of mortality with pullets up to six months The direct loss, plus the indirect losses due to loss of future cull sales and egg production, is explained, and also illustrated by means of a graph The figures show the necessity of rearing with low mortality by the use of sound proven rearing methods as described, combined with the background of good stock, if the poultry unit is to be profitable Under good conditions losses should not exceed 12½ per cent to laying stage If losses exceed 20 per cent through all stages, the debit on the remaining stock becomes a heavy drain on the returns of the farm

The economic aspects of selling month-old and ready-to-lay pullets as outlined in Chapter 8 shows the value of individual pullets at the various stages of growth Nearly 90 per cent of pullets and more are raised from day-old stage by those who carefully follow the practices outlined, using whichever method suits their particular system of poultry-farming This also shows the wisdom of paying a premium for sound, well-bred stock

LARGE ROOSTING-SHED FOR REARING AND LAYING

A practice that has been successfully used by many farmers where ample land is available for rearing purposes, or by orchardists, is as follows

A large roosting shed is built at the desired location After brooding and when pullets have been accustomed to the shed by means of a small enclosure and the early use of either weaning boxes or netting platforms inside, they are given full range This shed, built on the basis of one square foot per bird, is then used for the life of the birds on the unit Next year another shed is built sufficiently far away for stock not to intermingle and this new shed is used in the same way In other cases a dividing fence

QUARTERS REQUIRED

Pullets can be transferred from the brooders to the shed in which they are to be raised. In some instances they are raised from the day-old stage in a closed-off portion of the shed (refer to p. 166 and pp. 175-6, Chapter 10). Kerosene hover brooders can be used where electric power is not available, or infra-red lamps if electric power is connected. Brooding is usually carried out in the portion that can afterwards be the roosting-quarters. (In warmer areas the shed *may* be used with floor guard only.)

The weaning boxes or platforms referred to in this chapter can then be used, but adaptations employed by some poultrymen dispense with them.

ADAPTING SHED FOR WEANING FROM HEAT: ENCOURAGEMENT OF ROOSTING

Improvised weaning arrangements have proved efficient and labour-saving. One or two infra-red lamps are left on for a longer period than usual and the normal roosts are placed in position. Chickens will gradually take to the roosts, and lighting can then be gradually reduced in intensity by employing small-wattage globes, which will cost very little for power, but keep chickens contented and avoid an upset in conditions. Provision of temporary sloping ramps set against each side of the roosting-quarters, composed of wire-netting-covered frames rising nearly to the roosts, is a sound precaution. (Refer to illustration of roosts for young turkeys, Chapter 19, which have small roosts tacked on the top, as with the platforms shown in this chapter.) These ramps can rise nearly to roost-level over a distance of 3 or 4 feet. They can also be used with a kerosene hover set in the centre of this portion of the shed, heat not being cut off entirely until nearly all young stock are roosting. On the other hand, a number of operators merely use ample litter on the floor and place roosts in position and maintain light (or heat) until young stock are roosting. Care must be taken to see that the light or heat does not fail.

FLOOR AREA

A high protein ration which costs more per pound is needed to obtain results comparable with those of a lower protein ration fed to pullets under good range conditions Higher protein rations, when fed to outside range pullets did not show any advantage over low protein feeding in trials carried out Similar results were obtained when free choice of high protein concentrate mixture and grain was available to the pullets, the intensively reared pullets eating a higher percentage of protein than those reared outside on pasture (This would also apply with pullets being reared under battery conditions—in general the more restricted the area, the higher the level of protein required) Suitable rations are covered by Chapter 14 Other essentials are adequate feeding space, ample water space and availability of hard-grit (not shell grit)

DEEP OR BUILT-UP LITTER FOR INTENSIVE REARING

The intensive system of rearing cannot be followed on bare floors, and results where the litter is cleaned out frequently may be disappointing Deep-litter practice is essential for rearing pullets intensively, as it is with layers housed intensively Normal practice has been to commence with a good depth of fine litter—3 or 4 ins— (such as chaffed straw, hay chaff or sawdust or other materials as mentioned in Chapter 13) and this is added to as the pullets grow This litter is then continued on through the laying life of the birds Some operators have had good results by using some of the previous year's chicken litter as a basis for that with which to rear young pullets but in general start fresh litter with each lot Both earth and concrete floors have been used The litter will not remain in a satisfactory condition unless it is frequently stirred and handled as mentioned for adult stock in Chapter 13 Stirring is important, as litter—whether for rearing pullets or cockerels—must not be allowed to become damp and caked through overcrowding and/or poor ventilation or faulty shed construction It is vital that a permanent opening be provided at the back of the shed as well as the front to give enough ventilation to keep the litter in suitable condition

COMPARATIVE RESULTS OF INTENSIVE AND OPEN-RANGE REARING

General results indicate that with provision of dry deep litter, avoidance of overcrowding, and correct feeding practice, excellent pullets are raised under intensive conditions

The cost and consumption of feed will be higher than with range-reared stock, but labour routine and area needed will be much less

Cost of land and fencing for range rearing can be assessed against cost of extra housing for intensive rearing based on local prices With intensive rearing fewer losses are caused by foxes, hawks, crows, dogs, and cats (or through possible theft) as compared with open range It must also be realized that normal precautions in relation to coccidiosis, deworming, and vaccination should be carried out with intensive rearing as with range reared stock

The adoption of either system will be mainly governed by availability

and cost of land Where ample suitable and safe areas are available range rearing is recommended for economy and good growth, but comparable results can be obtained when intensive rearing methods are used correctly Labour required with range rearing would normally be more

SPACE REQUIREMENTS FOR PULLETS FROM FOUR WEEKS TO LAYING STAGE

Note These are minimum needs (in view of costs) in all cases—50 per cent increase will give better results

Floor space (rearing under intensive floor conditions):

4 to 9 weeks—1 square foot per pullet

10 weeks to near laying stage (16-18 weeks)—2 to $2\frac{1}{2}$ square feet per pullet according to whether light or heavy breed Then as for adults

Feeding space—(necessary to avoid feather-picking troubles, poor growth, culls)

4 to 8 weeks—at least 10 feet per 100 birds (one side) or 5 feet (two sides)

9 weeks to laying stage—at least 14 feet per 100 birds (one side) or 7 feet (two sides) Then 20 feet for adults.

Water space

4 to 8 weeks—2 to 3 feet of drinking space per 100 birds or 2 drinking fountains (2 or 3 gal capacity) Allow for 2 to 3 gallons daily consumption per 100

9 weeks to laying stage—3 to 6 feet of drinking space per 100 birds or 1 large-capacity fountain per 100 birds Allow for 3 to 5 gallons daily per 100

Ample cool water with sufficient space must be available at all times This is vital to good rearing results.

Roosting space

6 to 12 weeks—4 inches per pullet on the roosts or 30 feet of roosts per 100 birds, and 50 square feet of roosting-quarters space for each 100 pullets, with roosts 12 inches apart.

12 weeks to laying stage—6 inches per pullet on the roosts or 50 feet of roosts per 100 birds, and 100 square feet of roosting-quarters space for each 100 pullets with roosts 15 inches apart and 15 to 24 inches above ground-level

Range-rearing area

A minimum of 1 acre of pasture for 500 to 600 young stock and *preferably* only 400 to 500 to be used as one or two large enclosures; or individual yards can be used for each shed according to number and age of birds; e g 40 yards by 20 yards for one shed with 100 young stock. Some sub-division is advisable when different ages of stock are on the farm If possible spell the range for two seasons or at least do so periodically.

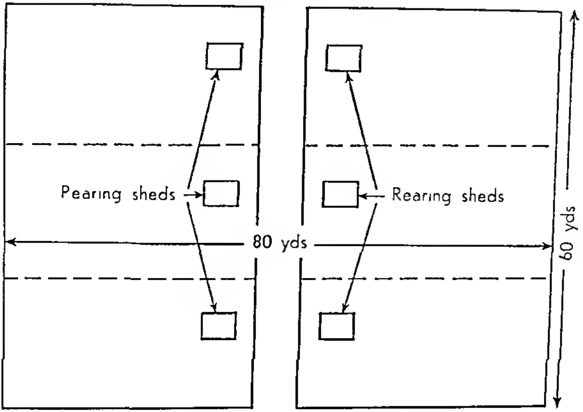


Fig 93 Ideal rearing-sheds layout on one acre

SUMMARY

1 Wean young stock from heated conditions gradually—refer to text for details of suitable weaners of different types, and provide *sufficient ventilation*

2 Adopt either free-range rearing or intensive according to the area available—one or the other must be used—*not* an attempt at a combination—and use the correct feed ration for the system used

3. Rear young stock on fresh ground completely isolated from older birds, and rear laying pullets and cockerels separately

4 Mortality among, and laying results of, adult stock are decided by rearing conditions given Other things being equal, good range conditions or intensive rearing may be expected to give comparable results with rearing stock

5 Study carefully the various systems of weaning arrangements, rearing-sheds, portable houses, or adapted laying-sheds, and use according to the capital available Slope and area of the property, and rainfall, will be guiding factors

6 Take care when changing chickens from one stage to another, as when moving from brooder to rearing shed—panic must be avoided and changes made gradually Note various safeguards listed to keep conditions (feeders, waterers, "warm corner", etc) as nearly comparable as possible

7 Provide adequate range or shed space as recommended, and also sufficient feed and water space The avoidance of overcrowding on floors

and roosts, around feed and water, is stressed as vital to good rearing results to reduce culls and prevent vices

8 Guard against disease by measures such as breeding chickens from blood tested birds, observing correct husbandry, use of good management for coccidiosis prevention Also deworm young stock, and vaccinate for fowl pox or tick fever (and Raniket or Newcastle disease in developing areas outside Australia) as required in any particular locality

9 Watch feed consumption—the basis shown in the text gives a guide Do not starve growing stock of their full requirements—but do not allow waste Use good feeding arrangements and remember the value of green-feed—in wet or dry form—for health and reducing feed consumption

10 Keep a watch on size of growing pullets—it pays to cull poor specimens Also check on conditions to see that defects are not responsible for the culls

11 Provide sufficient ventilation and give good litter conditions for pullets being reared intensively

12 *Check the list of space requirements for growing stock*

The success of the rearing period with pullets is one of the biggest factors on which the returns of the farm are based Weak, poorly-grown pullets cannot lay the maximum number of eggs—care and attention given to this aspect of poultry-farming is very important to the efficiency of a unit General climatic conditions in Australia during the normal rearing season are favourable to good results, less elaborate equipment being necessary than in colder countries Pullets fed correctly for the system adopted, and benefiting from the various safeguards suggested for their rearing, should have low mortality, and be capable of egg production appropriate to their breeding background

Footnote What weaning arrangement is best? Many alternative methods of weaning have been listed They should meet needs from small side line operations (where portable units *might* have a place, but most would prefer the small sleeping-box in the corner of the shed) to the large scale operator who would probably prefer the weaning platform approach

The large scale operator raising meat or laying stock on deep litter would continue use of the hot brooder on the floor for longer period, in the low heat level, and dispense with weaning adjustments The wire cage operator for eggs or meat would obviously adopt the battery weaner or "follow on" brooder These suggestions would apply also for developing areas

CHAPTER 12

HOUSING ADULT POULTRY

CORRECT housing of laying stock is vital to the success of any poultry farm. No one system of housing can be claimed as the best for health of stock, and for high-level egg production Many examples can be given of high production in various types of houses Important factors to keep in mind when trying to decide on the best type of house are rainfall and range of temperature in the area where you are operating Other factors are capital for erecting laying sheds (the major item of capital expenditure on most poultry units) and area and cost of land available This has a considerable bearing on the type of housing that can be adopted.

The lead of successful farms in a particular area can be a guide to an inexperienced person.

Reference was made in Chapter 4 to the importance of climate, and its effect on the type of house to be adopted Examples mentioned there indicate that very simple and economically constructed sheds can house birds that give excellent production figures—particularly in the winter—when used on the plains with rainfall about 10 inches annually, as can laying-cages with suitable safeguards for high-temperature periods Also, small intensive units or battery laying systems would be suitable under high-rainfall conditions in hilly areas—and so on Reference can be made to Chapter 4 for coverage of these points, the reminder being given here to indicate that many considerations are involved in the suitable housing of adult stock

Endeavour is made to describe and illustrate types of housing suitable for the farm lay-outs given in Chapter 4 General features of each system will be presented as a basis, and variations can be made to suit materials available. The main point with these sheds is not the use of certain-sized timbers or roof coverings—of real importance are general dimensions and provision of ventilation and handling facilities Every endeavour should be made to see that the shed is a sound job, by using the best material one can afford Well-constructed sheds save on maintenance, and when properly set out keep labour of routine work to a minimum and make a farm that is a source of pride, as well as a means of livelihood

MATERIALS FOR SHED CONSTRUCTION (AND SOME CONSTRUCTION HINTS)

Materials available throughout Australia vary greatly For this reason general dimensions and coverages required will be listed Materials available in particular localities can then be used and costed for local values

Some materials suitable for shed construction are as follows:

Fig. 94. Well-built sheds in attractive surroundings.

Roof: Corrugated asbestos sheets, galvanized corrugated iron, aluminium, roofing tiles, and roofing felt supported on timber. On some general farms with poultry as a sideline "thatched roofs" have been used.

The main essential in the roofing material is that it be quite weatherproof. Using a roof that lets water through is asking for trouble, whether on intensive or roosting-sheds. Try to allow about three or four feet between purlins (the pieces of timber to which the iron or asbestos is nailed) and have substantial rafters to prevent sagging or loss of roof in a storm. Always take the precaution of bolting rafters to the front and rear posts, and twist a wire around the purlins and under the rafters. In areas subject to gales wires from rafters to concrete blocks in ground in front of shed have been used as anchors. Nails may not hold in a storm.

The shed roof should overhang sufficiently to prevent summer sun shining in, while allowing winter sunshine to enter. (Insulation under the roof is also very helpful in summer.) Sufficient ventilation is essential. It is important in litter control and in promoting health of birds.

Walls and slatted sides: Galvanized iron (corrugated or flat), asbestos sheets (corrugated or flat), concrete blocks, bricks, stone, palings, drums cut open, rolled and corrugated (or left flat). Cheap sides have been made with bags cut open and treated with cement wash and attached to a framework.

(A formula for cement wash: 1¼ gallons water, 12 lb. cement, 2 lb. lime, 1 lb. salt, ½ lb. alum. Sieve materials, mix well, and keep stirred. Apply two coats—second coat after first has dried. Keep wet for three days.

the rear of sheds shown in this chapter, under most conditions

Supporting material for roof and sides Soft timbers have been used for carrying roof and side coverings of a shed, though not needed for sides of brick, stone, or cement Side timbers are often eliminated by placing the upright hardwood posts the correct distance apart to allow galvanized corrugated iron or flat asbestos sheets on edge to be nailed to each post This makes a good shed, gives less harbour for vermin, and saves timber Long sheets are the most economical, and it is advisable to use a gutter bolt or two with iron on the edge flutes in between the posts The grade of timber should be good if possible, for longer life than native timber

TUBULAR AND ANGULAR STEEL CONSTRUCTION

The advance of building practice has brought the use of tubular steel into the sphere of poultry shed construction Excellent sheds can be constructed by using this method of support It is practically everlasting, offers very little harbour for vermin, has great strength, and allows of prefabrication of the shed Serious consideration could be given to this point, because of its economic value and numerous advantages This type of construction is also popular for battery-cage sheds The same comments apply equally for angular steel supports The use of steel is spreading widely for all types of sheds in the industry

Floors Concrete floors are very popular because they facilitate sanitation and control of external vermin, are durable and easily cleaned Bitumen-treated floors can also be used Many farms have obtained excellent results with floors of hard clay or of natural earth The floor should always be above surrounding ground level to prevent dampness

The question of cost can often be the deciding factor, and a basis of assessment is given later in this chapter

Roosts Timber should be used, not iron Three inch by 2 inch timber on edge, slightly rounded on top (or 2 inch by 2 inch for short roosts) is suitable Native timber has been used on many sideline farm units This works quite well, but keep watch for vermin, particularly tick or red mite (Kept on level to prevent fighting as with "ladder" roosts)

Nests These are discussed in Chapter 16 (See pp 405 8)

Feeders Dealt with in Chapters 14 and 17 (15 feet to 20 feet available both sides per 100 birds for wet mash and 20 feet available one side for 100 birds on dry all mash is needed) (See p 331, pp 461-2, and p 650)

Waterers Dealt with in Chapter 17 (provide about 6 feet of drinking space available one side for 100 birds) (See pp 449-52 and Appendix 2)

TEMPERATURE, MOISTURE, AND VENTILATION IN SHEDS

(See also under Climatic Conditions, Chapter 4, pp 43-4)

The main purpose in constructing sheds for poultry is to control the effect of weather variations (and to increase the efficiency of labour in handling birds commercially) Poultry roosting in trees can remain in good health, but their laying results deteriorate under extremely cold and very hot conditions Loss of body heat in winter means that a higher percentage of food eaten is needed for bodily requirements, and in very hot weather the hen has difficulty in disposing of excess body heat, which also depresses laying rate

A shed serves to reduce loss of body heat and also to minimize the effects of very hot weather These aims have been allowed for in designing sheds for various localities Climate is the main reason for the use of different housing methods in various localities even within the same State The ideal range of temperature for maximum production is 55°F to 75°F (This range has been established as the result of temperature recordings in normal sheds, and also controlled environment tests Greenwood's work at Edinburgh University showed very high level production without normal winter reduction in laying with pullets held at 65°F with 60 per cent humidity and twelve hours' light daily Some later workers indicate variation with lower night temperature is beneficial)

Important points that must be considered are shed ventilation and the moisture problem Sufficient ventilation must be provided both in the front and at the back of the shed to keep the air in a relatively fresh condition In general sheds in Australia have been closed up far too much as compared with the practice used in California, and as needed in hot areas The necessity is to remove the moisture that accumulates within the shed owing to the breathing of the birds, the high moisture content of the droppings, and water spilt when drinking or respiratory troubles and damp litter has created problems (The total amount of respiratory water, and water voided in the droppings is about 2 tons per month for 300 birds, according to Professor Morley Jull, University of Maryland, United States, in his well known book *Poultry Husbandry*) High rainfall conditions pose a greater difficulty in disposing of this accumulation A review of these factors shows that many points must be considered in building a shed do not close it up in winter too much to keep birds warm This impairs ventilation—and further problems arise The idea is to balance the various factors as well as possible, keep the shed well opened up—and provide some means of adjusting the shed to very cold conditions For example slats at the side of cages in the winter

A basic rule (emphasized often) is *do not overcrowd the shed!* If you do, temperature, ventilation, and moisture problems become too acute, and poor laying and poor health with respiratory troubles will result from damp, smelly sheds

SUITABLE METHODS FOR ADOPTION

The problem of temperature control in laying houses is dealt with according to rainfall and temperature range

Low-rainfall Areas

Where rainfall is very low—in the vicinity of 10 inches—indicating high summer temperatures and mild winters, open-fronted sheds can be used The roof material should be capable of reflecting heat Materials such as aluminium can be used, otherwise paint the roof on top with white or aluminium paint and consider value of insulation under the roof The back of the shed may have a door (open nearly to ground-level) at least every 20 feet, in addition to a ventilation gap under the roof—usually of 6 to 12 inches If very large numbers in one shed are kept intensively in areas where high temperatures are experienced, it is advisable to allow a larger permanent ventilation gap and more openings at the back of the shed (See Dryden Shed Reference p 231) If the shed is protected by trees or a hedge it can be fully open The use of deep litter is helpful in summer (as well as in winter) for birds cool themselves in the litter and dampening it then helps both the birds and the litter An additional measure to reduce the effect of high temperatures is the spraying of the roof One easy way of doing this is to have a greenfeed area near the shed and the irrigation facilities can serve a dual purpose, otherwise use overhead sprinklers (or internal de-misting system) To sum up with high temperatures* and low rainfall, use open front sheds, heat-reflecting roof, ample ventilation at rear of shed—*and* see Appendix 2 for further information

High-rainfall Areas

Where high-rainfall conditions are combined with low and high temperatures for a period of the year, the approach is different

Materials such as asbestos are suggested for the roof, as with wet foggy conditions there is less trouble with condensation—a problem with metal roofs Asbestos is also suitable for the sides or walls of the shed, while stone, brick, or cement are excellent Hedge or tree protection to prevent cold winds from blowing directly against the shed will assist in keeping shed temperature higher in cold wintry weather Front of shed can be closed up about half-way, but not farther lest light distribution and ventilation be affected Sheds 25 to 30 feet deep can be nearly open fronted and still give warm winter conditions Slope of roof can also control temperature and ventilation If the roof is too flat circulation of air is too sluggish If there is no movement of air in the shed, condensation will occur Therefore do not close any rear ventilators under the roof completely at any time, needed at all seasons of the year (The good results with Dryden type sheds indicate need for ample ventilation for all seasons) Roosts should be 16 to 18 inches apart to give sufficient ventilation

Light in Shed

Even distribution of light on the floor of a shed is necessary in promoting feeding exercise and occupation when using deep litter The allowance should be about 25 per cent of the floor space for the front opening Thus in a 17-foot deep shed the opening should be about 4 feet (about half of

* Poultry sheds designed to suit climate —an article by R V Byrnes, Poultry Adviser, Department of Agriculture and Stock, is a reference for need for coolness and ventilation with high temperatures in Queensland climate

the front) and in a 30 foot-deep shed the front would be nearly completely open to give 7 to 8 feet This will give an even spread of light Also the quarter to which the shed faces is important Face the shed the right way It must face somewhere in the quarter between north and east in Australia The best direction is north, but it may suit the lay out or slope of the plant to vary this to east of north The winter period poses the greatest problem in this respect, and all possible sunlight at this time should be allowed in the front of the shed in order to help raise shed temperature and keep litter dry Land for sheds should not be in a gully with steep sides, the sheds may be without winter sunshine To get this winter sunshine the shed must face as near as possible to north Also, for protection from both driving rain on occasion and summer sun, have the shed roof overhang in front about 3 feet in a 20 foot deep shed and about 4 feet on open fronted 30 foot-deep sheds

Deep Litter Equalizes Temperature

Concrete floors laid on the ground or earth floors gain warmth from the ground in winter—an effect similar to that in a cellar—whereas they tend to foster cooler conditions in summer When deep litter is used, it insulates against transfer of heat, and birds retain their warmth in winter, thus saving feed and reducing heat loss referred to before On hot summer days the litter is also a great advantage because it equalizes conditions as it is lower in temperature than the surrounding air Birds then burrow into it because of this This makes it a valuable safeguard in heat-waves and in winter because it maintains a fairly uniform temperature over the year

Water Provision

Ample water is required at all times of the year Where temperatures fall low enough for water to freeze at the edges of the shed it is best located inside Keep water separate from litter area (Where freezing temperatures occur electric heating devices are used to prevent water freezing with a consequent improvement in production) With high summer temperatures the water should be ample, clean, as cool as possible, and easily accessible (*Note* Most of the points covered for temperature, light, ventilation, water, and sheds would apply to any system of running birds inside the shed—in cages or on the floor)

Labour Requirements

Intensive shed units can be handled with least amount of labour Collection of eggs and feeding are much easier and minimum distance travelled on these tasks, allowing more birds to be efficiently handled

Conclusion

The foregoing will give the reader an idea of the basic thought necessary in deciding what type of shedding is suitable for a given locality

TYPES OF SHEDS

The types of sheds on which information will be given are some of those which have been successfully used in Australia Variations from these

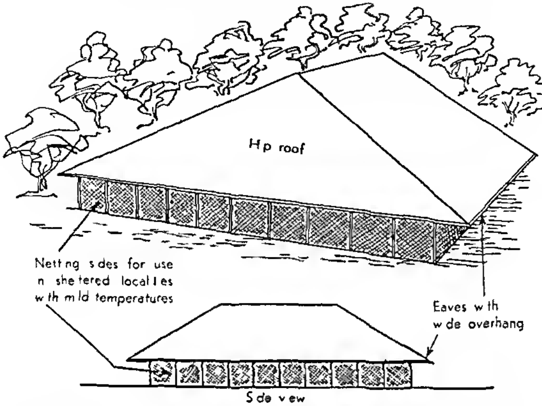


Fig 95 Illustration of 1000-bird intensive shed (This open sided type construction with overhanging roof—for pens of varying sizes—is well suited to monsoon climate areas)

Crossbreds (first cross) are used in these units Results have been very good under the hot West Australian weather conditions (The cost of this type of shed is higher per bird housed than for those listed in this chapter with lean to roof construction for 350- to 400-bird unit, owing to the greater cost of building and covering the high overlapping roof structure However, this type of roofing gives cool summer conditions)

Efficient husbandry methods are demonstrated with the units illustrated in Fig 96 These follow on standard lines of correct hatching time with chickens from blood-tested stock, rearing with balanced rations, and a routine deworming and fowl pox vaccination programme during the period of raising the pullets

This is followed for the adult stage by feeding of correctly balanced all mash, artificial lighting of sheds for autumn and winter, and a very high percentage of pullets among layers on each unit Careful records are kept of operations These units serve as examples of the value of good poultry husbandry, but it is stressed that the husbandry skill of the operator has to be high in order to handle a thousand birds in a group successfully. The majority of operators have much smaller numbers of birds per pen

FREE-RANGE UNITS

1000-Bird Unit on Free Range

Reference has been made in Chapter 4 under Farm A to a free-range type unit worked with one large roosting shed (see pp 45-6) when allowing

the birds unlimited range This has worked satisfactorily on well-drained locations where birds can roam as far out from the shed as they wish The normal usage of this type of unit has been where a large sideline unit is run on a general farm, but commercial operators have used it in suitable well-drained and sandy areas with low rainfall A long fence (low fences will do with this system when heavy breeds or crossbreds are used) is needed to protect the house, yard, and general outbuildings area, and one fence to cut the shed in two will be needed if two ages are run Crossbreds and heavy breeds are best suited to the system, from ranging point of view and for having eggs less easily stained, but White Leghorns have been successfully used

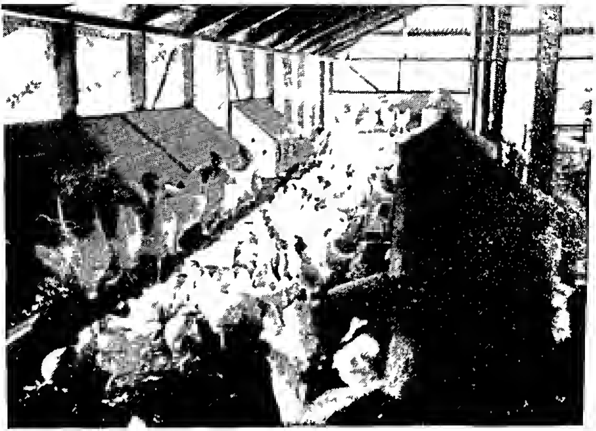


Fig 96 Inside view of shed on a pilot farm Note nests, all mash feeders, and roosts Other types of sheds are also used Pilot farms are examples based on sound husbandry Existing farm sheds have been used in a number of cases and the principles used can apply for sheds of varying sizes

Details and Handling Procedure

The shed shown as an intensive shed 80 feet by 17 feet for 400 White Leghorns can be adapted for this purpose It will need the provision of 550 to 600 feet of roosting space for the thousand birds The roosts should be spaced not less than 18 inches apart, 3 feet above the ground This will mean seven roosts along the back of the shed and 10- or 11-foot depth of shed will be used To provide sufficient space feed has to be given outside either in weatherproof dry-mash hoppers, or in feeding troughs for wet mash Verandas can be constructed for the shed, but too many additions rather defeat the object of a cheap shed for the number of birds handled,

and can upset ventilation. The labour of attending the birds is reasonable, as feeding and watering arrangements can be worked close by the one shed. A cement-covered area around the shed will improve conditions for wet periods. The work of cleaning eggs will be heavier in wet weather than with intensive units. Colony nests would be the most satisfactory. Five colony nests for each side approximately 7 feet long by 2 feet deep will fit nicely inside the shed front and will give ample space. If kerosene-tin type nests are used it will be necessary to provide about 70 nests for each side, which would mean two tiers of 35 nests occupying about 26 feet by $1\frac{1}{2}$ feet. If the shed is handled as one unit then 10 colony nests or 140 kerosene-tin type nests will be needed in line inside the shed. Sufficient nesting space is very important, and when a large group of birds are together collection of eggs must be carried out three or four times daily. A practice that is

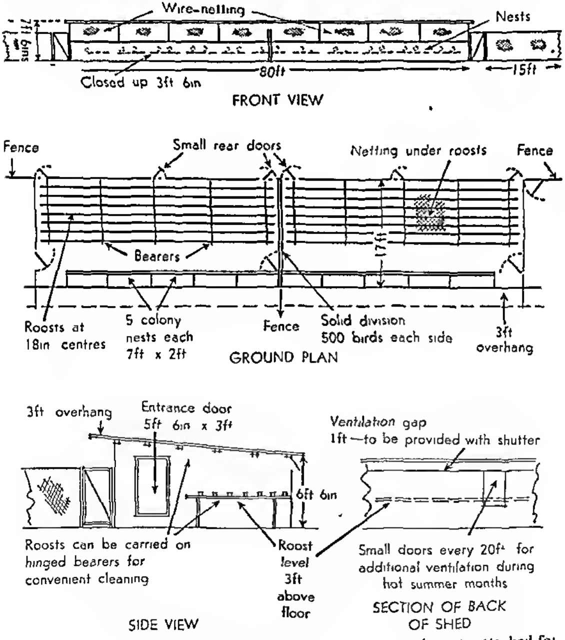


Fig. 97. Shed 80′ x 17′ adapted as roosting quarters with nests attached for 1000 birds.

recommended is to have netting under the roosts to prevent the birds getting in the droppings This can be arranged by running netting over the bearers, but under the roosts, or be worked in the form of frames with the roosts on top and hinged in sections for cleaning out Alternatively have the lower portion of the back of the shed hinged at roost-level This can then be opened to permit all cleaning of droppings from under the roosts without entering the shed (This can also be used to increase ventilation in the summer This provision can apply with other sheds also—adaptation on Dryden shed lines) Longer periods can then be left between cleanings, and eggs will be much cleaner Also it can be arranged to have a steep sloping ramp of netting up to the nests from the floor—this assists in cleaning birds' feet, and saves eggs being laid under the nests Egg collection is quite convenient, being under cover The portion in between roosts and nests should be kept as clean and dry as possible Deep litter is not likely to work, and replenishment of floor material will usually be needed, or sand or sawdust could be used This system has management problems, but can be worked for handling poultry on range without uncontrolled running of birds over the farm By centralizing the shed the feeding and egg collection are made comparatively easy It is really a compromise with open range, embodying sufficient roosting space (instead of scattered roosting) and the use of centralized nests and feeding at one point Also it involves rearing large numbers of pullets, preferably from one hatching and even in growth—a separate enclosed rearing area has to be used (Refer to Chapter 11 for rearing information) The health of stock under these conditions is excellent and reasonable laying results are obtained in suitable areas Although the laying is usually below that of units with smaller pens, the saving of labour is considerable, and many operators have handled poultry in this way to fit in with general routine on farm (Some operators move the shed every few years) Breeding stock handled in this way can produce good chickens (For cost basis refer to Intensive Sheds for 350 to 400 Birds—this shed is the basis and is used here in adapted form See pp 226-7)

Alternative Use of Free-range System

(using smaller shed units and individual yards)

This has also been referred to in Chapter 4 and a plan of general lay-out is shown (See pp 46-7)

Where fewer birds are to be handled in each flock with this system, it becomes necessary to use smaller sheds spaced at reasonable distances apart to allow the use of sufficient area by each lot The idea is to provide each one hundred birds with half an acre of land This system has worked well with many orchardists running poultry as a sideline among the trees Rotation of yards every few years is needed for best results Enclosures will be necessary for each group if the sheds are reasonably close, but if spaced sufficiently far apart each flock will normally return to its own quarters (Take measures against foxes) Small sheds of a fixed or portable nature can be used (It is possible to work the sheds as portable units with a yard of hurdles attached and the combined shed and yard moved frequently on the lines of the English "fold" system)

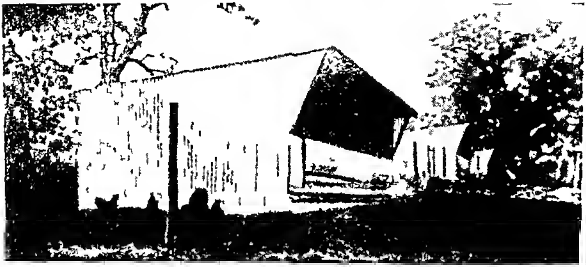


Fig 98. Controlled free range Sheds for 300 birds each are set in line and approximately 1½ acres is netted for each shed, with runs at rear Feeding is by wet mash in tiers of troughs outside, as with water (Alternatively, use dry mash hanging feeders) Nests are set just inside front of shed, well shaded by the overhang Sheds facing the roadway save labour for feeding, watering, and cleaning

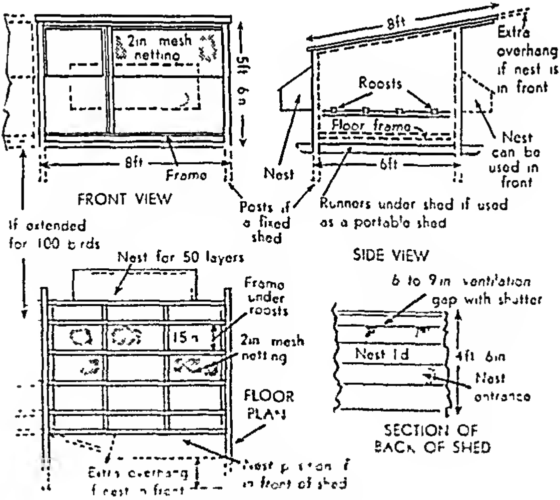


Fig. 99. Suggested shed 8' x 6', with a height of 5' 6" in front and 4' 6" at back. Used for 50 layers either as a fixed or portable shed

Small Fifty-bird Free-range Unit

A shed 8 feet by 6 feet can be used for fifty birds. This should be half open in front and have a 6- or up to 9-inch hinged ventilator at the back under the roof. The height in front can be 5 feet 6 inches and at the back 4 feet 6 inches. It can be constructed with four roosts giving 32 feet of roosting space when these are set 15 inches apart (the last roost 9 or 10 inches from the back of the shed). These sheds have been used with a colony nest 5 feet long by 15 inches wide attached to the rear of the shed set at convenient height for collection of eggs. Birds enter the nest from inside the shed. In a portable shed, as may be used in orchards, heavy gauge wire-netting (2-inch mesh) should be set at the bottom of the shed 6 to 9 inches above ground-level, and the roosts about 9 inches above the netting. This makes for cleaner eggs, as the birds approach the nest over this, instead of through the droppings under the roosts. If the shed is fixed then a frame that slides in from the front of the shed can be used—to be pulled out for cleaning. Tests with these units have shown good production is possible; part-year lay is also used by some operators—birds disposed of when fruit ripening. (Further details in *Fig. 99*)

Fig. 100. Layers on range in an orchard when using small free-range houses This works well under good rainfall and drainage conditions

Hundred-bird Free-range Units

Two of these sheds can be combined to form a hundred-bird unit either 12 feet by 8 feet or 16 feet by 6 feet Two side walls can be saved in this case, the whole being worked as one shed. Two nests on the back can be

used, or one larger colony nest 7 feet 6 inches by 2 feet could be used Other details are the same as for two separate sheds (Two frames would be used for the floor in a fixed shed)

This description and the diagram given will serve as a guide to the construction of these small free range roosting-sheds

Note It is quite practicable to work the above sheds by combining a number in a row without divisions and have 400 to 500 birds in one group with suitable well drained range This could mean a shed 60 feet by 8 feet for 500 birds Nests could be on the front under an extended overhang (about 3 feet) or at the back Four or five roosts would be needed according to breed Netting frames or netting under the roosts as for 80 foot by 17-foot shed could be optional in this case (Reference can be made to Chapter 11 for further details, as this shed is an adaptation of the 8 foot by 6 foot rearing shed shown there, pp 196 9)

Costs for 8 foot by 6-foot Shed with Removable Frame

(This will serve for either rearing shed or 50 bird free range laying shed Add cost of a colony nest for laying shed as only adjustment)

		Approx cost
Roof covering		
7 sq yds cor asbestos @ 60c sq yd	\$4 20	Average \$4 20
or 4—8 ft cor iron sheets @ \$150 per ton	\$4 20	
Covering for 2 sides, back and front		
14½ sq yds flat asbestos @ 40c sq yd	\$5 80	Average \$7
or 1—8 ft for front, 6—6 fts for sides, 4—5 fts for back @ \$150 per ton	\$8 50	

	Approx super feet
Softwood	
Rails (3 at back, 3 at front) 6—8 ft lengths 3″ x 2″	24
Top rafters (2) 2—8 ft lengths 3″ x 2″	8
Sides (at bottom to carry frame) 2—6 ft lengths 3″ x 2″	6
Front short rail 1—5 ft length 3″ x 2″	2½
Frame 4—6 ft lengths and 2—8 ft lengths 3″ x 2″	20
Roosts 4—8 ft lengths 3″ x 2″ (or 2″ x 1½″)	16
2 Bearers for roosts 2—6 ft lengths (bolted to wall of shed), can be 2″ x 2″ if desired	6
Door 18 ft 3″ x 1″	4½
Hardwood	
Posts 2—7 ft x 3″ x 2″, 2—6 ft x 3″ x 2″, 1—5 ft x 3″ x 2″ (along side door—this upright can be softwood if desired), making 31 ft 3″ x 3″ hardwood	15½
TOTAL TIMBER approx *100 super feet—if average price \$10 per 100 sq ft*	\$10
Sundries	
8 ft of 3 ft x 2″ mesh netting for front of shed and 8 ft of 6-ft x 1″ mesh for frame when used for rearing, but 2″ mesh when used for adult stock, small board for ventilation opening at back, screws, nails, and hinges approx	\$3 30

Without a solid floor, total cost is approx \$24 50 for the shed.

INTENSIVE HOUSES FOR 350 TO 400 BIRDS

Poultry-farmers in Australia have successfully handled large pens or sheds containing 350 to 400 birds The larger the shed, and subject to ventilation efficiency, the less area needed per bird down to $2\frac{1}{2}$ square feet minimum These sheds have been of lean-to type and are worked with deep-litter practice Variations in size can be made Sheds 80 feet long by 17 feet wide (1360 square feet), 60 feet long by 20 feet wide (1200 square feet), and pens in a 30-foot-deep shed approximately 40 feet long (1200 square feet) have been used On the basis of 3 to 4 square feet per bird (according to rainfall), these will hold 350 to 400 birds Height in front of the 17-foot- and 20 foot-deep sheds is $7\frac{1}{2}$ to 8 feet, and on the 30-foot sheds from $9\frac{1}{2}$ to 10 feet Approximately 6 feet to 6 feet 6 inches height is allowed at rear The usual provision for ventilation at back of shed is a door every 20 feet as well as an opening of 6 to 12 inches right along the rear of the shed just under the roof Adaptation of rear of shed as per Dryden type (p 231) can increase capacity by 15 per cent This would be best suited to the 17 feet or 20 feet deep sheds

Fig 101 Section of a shed 80 x 17, housing 400 birds as one flock Sheds of this type are economical of labour, and with efficient husbandry give good production figures

The roosting arrangement can be one-quarter or one-third of the shed at one end for roosting purposes, or three or four roosts could be set along the rear of the shed, for the 60-foot-long or the 80-foot-long shed respectively The dry mash feeders shown in Fig 102 are suited for dry mash fed with grain Double in length for all mash The feeder height allows for deep litter build up The separate roosting area, particularly where this type of shed is to be used for rearing purposes as well, makes it much easier to handle * This portion can be used as the brooder room in the early stages In the 30 foot-deep pen with less length the number of roosts would be increased to five or six according to breed

* When used in this way a plant that is very efficient and economical of labour is possible Chickens do not need any moving other than breaking down the numbers into two sheds when half grown Sheds are used in rotation as birds are cleared at the end of their laying period

Subdivision of Sheds

A shed of the type shown (80 feet by 17 feet) can be subdivided into four pens of 85 to 100 birds (up to 120 per pen with Dryden adaptation—*and* increased roosting, feeder and water space) Easier control is possible and labour is not materially increased where communication doors are used This applies with 17-foot- and 20-foot-deep pens and particularly if 30 feet deep * The doors can be set in each division just inside the front, in addition to front doors in at least every other pen This still makes possible easy routine and rapid collection of eggs as with the undivided shed (under cover in all weathers—alternatively a small porch can be made in front to serve each 2 pens and the nests sit against this for outside egg collection)

Note Egg collection has to be carried out more frequently in large pens than in smaller pens because of the habit of birds crowding certain nests (Hanging feeders can replace the built-in type shown in Fig 102)

Costs for Shed 80 feet by 17 feet (1360 square feet)

Seven feet six inches high in front, 6 feet 6 inches high at back Front closed up 4 feet Ventilation gap at rear at least 6 inches, and 12 inches or more in hot areas Costs will vary with ruling prices in any locality

		Approx cost
Roof covering 200 sq yds (with overhang and allowing "overlaps")—		(1)
if corrugated asbestos @ 60c sq yd	$120	$120
—if galvanized iron ap 16 cwt (80—7-fts and 40—8 fts @ $150 per ton	$120	Average
Covering for ends, back, one division allowed, and front half way—140 sq yds—		
if flat asbestos @ 40c sq yd	$60	Average
if galvanized iron ap 12 cwt @ $150 per ton (55—7-fts and 35—8 fts)	$90	(2) Ap $80

Softwood		*Approx super feet*
Roof—		
Purlins—7—80 ft lengths 560 ft 3″ x 2″ for iron (280 sp ft) or 560 ft 4″ x 2″ for asbestos (ap 370 sp ft)	Average	325
Rafters—9—20 fts 5″ x 2″ (supported by a middle post) = 180 ft 5″ x 2″		150
Side and division rails—6—18 fts 3″ x 2″ = 108 ft 3″ x 2″		55
Doors—1 *in front, 1 in division* each 6 ft x 3 ft, and 4 in back of shed each approx 6 ft x 2 ft or 5 ft x 3 ft = 160 ft 3″ x 2″		80
2 back and 2 front rails—320 ft 3″ x 2″		160
Roosts—240 ft 3″ x 2″ and 60 ft for bearers = 300 ft 3″ x 2″		150
Nests—support for 50 nests if kerosene tin or drum type (double row) would require 100 ft 3″ x 2″ for rails and supports (50 sp ft) also 50 ft 3″ x 1″ for landing rails (12½ sp ft)		60

* Labour can be reduced to a minimum for feeding, egg collection, and also cleaning operations by the use of a mono rail system with these types of pens The overhead rail is set at the top of the communicating doors and the bin or platform suspended so that it can be pushed through with feed, or egg baskets or fillers, and cleaning can be simplified by using the bin to take out manure The bottom of the bin or small platform travels about 18 inches above the litter (The doors are hinged with double acting hinges)

Hardwood—3″ x 3″ shed posts—one post every 10 ft, 13—9-fts for back and 20—10-fts for front and for middle (including 6 extra at doors) = 33 posts (approx 320 ft 3″ x 3″)	240
TOTAL	1220
	(3)
If average price of $10 per hundred super feet Approx	$120
Sundries	(4)
Front netting, nails, hinges, screws, bolts, wire netting for door openings at back approx	$30
Total Approximate Cost—(at these prices and with earth floor) for (1), (2), (3), and (4)	$350

Note If purlins, the biggest individual item in the roof, were spaced just over 5 feet instead of approximately 3½ feet this item would be reduced by a hundred super feet—$10 on this basis This could be the order *with iron* (or aluminium) but not with asbestos

These figures can serve as a general basis when these materials are used Calculation can be made for variation in price per square yard of coverage or per super foot for timber

Floor Cost

Earth or clay floors can be used, but where concrete is adopted a suggested basis is given A mixture of one part cement, three parts screenings (approx ¾ inch) and five parts sand can be used This can be finished or "floated off" with a thin layer of cement for a smooth surface When the floor is about 2½ inches thick, the following is a possible basis for 1360 square feet in the shed (a very heavy floor is not necessary in a poultry shed—variations can be made to the mixture as desired) 2 loads sand, 2 loads screenings, and 55 to 60 bags cement (loads refer to normal tip-trucks) With sand $8 load, screenings $12 load, and cement $1 50 bag, total cost would be $130 for 1360 square feet (If costs cheaper, increase quantities to give 3 inch average thickness) The combination for shed ($350) and floor ($130) with these prices would be $480 for 400 birds ($1 20 per bird at 3 4 square feet)

Costs for Shed 60 feet by 20 feet (1200 square feet)

Materials would be less Roof 160 square yards, sides 125 square yards, purlins 240 super feet, rafters 135 super feet, rails 60 super feet, doors 70 super feet, roosts 150 super feet, nests 60 super feet, posts (26) 190 super feet This means $170 for covering, and for 905 super feet of timber $92 and $28 for sundries *The approximate cost*, on the basis of the figures used as examples for the 80 feet by 17 feet, *would then be* $290, and the approximate cost of a concrete floor on the same basis would be $110 The combination would be shed ($290), floor *($110)—approximately* $400 for 350 to 400 birds ($1 to $1 15 per bird at 3 to 3 4 square feet)

Costs for Shed or Pen 30 feet Deep by 40 feet Long (1200 square feet)

The cost would be reduced in these pens because, although average height of sides would be increased owing to increased height of front,

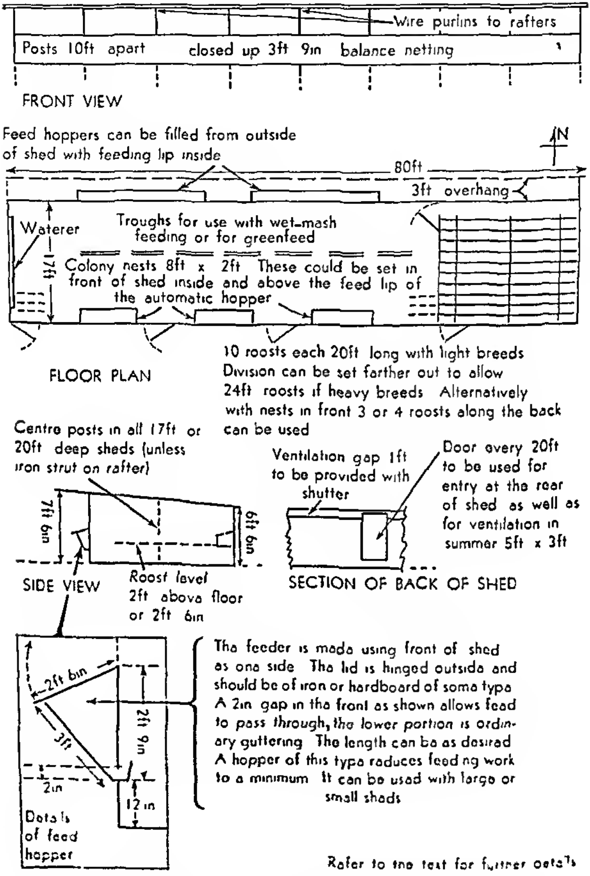


Fig. 102. Shed 80' x 17' as an intensive shed for 350 to 400 birds, the higher number of birds in mild climates and with light breeds.

there would be a saving on front of shed with netting instead of iron half way Also there would be a saving of 20 feet in the outer shed length The overall amount would be nearly 20 per cent saving on timber and covering on sides and front This would save approximately S30 with the same floor area It is cheaper to build a nearly square pen than a long narrow pen In this case the outside length would be 60 – 60 20 – 20 160 feet for the 60 foot by 20 foot shed, and 40 – 40 – 30 – 30 – 140 feet for the 30 foot by 40 foot pen This fact may be of assistance in planning lay out of pens The approximate cost is S270 for the shed on the same costs basis Floor would cost the same, as area is unaltered The combination would be shed S270, floor S110 – S380 for 350 to 400 birds (approx S1 per bird)

Note Deep sheds of this type suitably subdivided are sometimes used to form 'sawtooth' sheds, the back of the first shed becoming the front

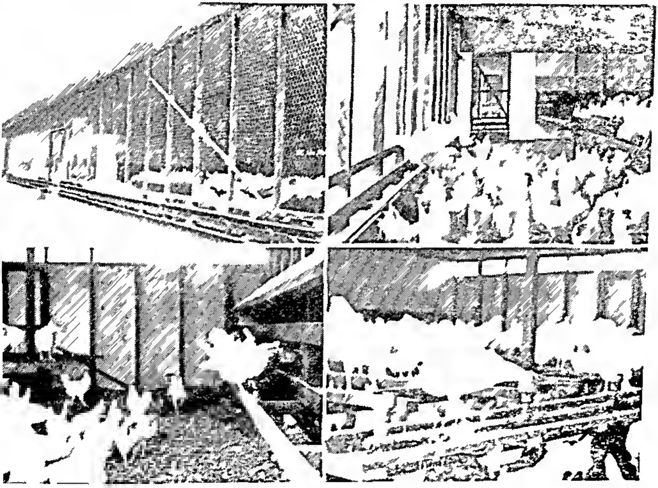


Fig 103 Large intensive house in New South Wales containing over 2500 birds *1* Front of house nearly fully open for deep pens of this type Two tiers of feeders in front allow ample space for feeding Birds of second tier stand on a rail to feed Labour is reduced by feeding from front and having doors in front and in the division *2* Inside a pen showing doors in the division allowing for convenient collection of eggs under cover Arrangement of roosts and nests can also be seen *3* Inside one of the pens showing location of nests and permanent rear opening under roof for ventilation Deep litter can also be seen *4* Automatic water system Hens drink from galvanized reducing sockets screwed into a tee in the waterline and water is held at a set level

—(*By courtesy of* Poultry)

of the next behind it (roof sloping from 10 feet in front to 7 feet at back: the 3-foot opening becomes the open portion of each succeeding section). Two or three sheds have been joined in this way. Artificial light is, of course, used for winter in these pens as normal practice. These sheds save some material in building, and routine work for feeding and egg collection is reduced. Handling units of this type calls for a high standard of management.

Conclusions

The information given in this section should serve as a guide to the building of sheds that can be used for 350 to 400 birds, according to breed and to rainfall of a locality. These intensive sheds save labour with less distance to be travelled for all routine operations. Estimated costs will be subject to adjustments for local prices. These pens, in combination with careful husbandry, have given good results.

Note: These sheds (whether orthodox *or* with Dryden adaptation) can be used for flock mating quite successfully without runs, provided that the correct breeding ration is fed.

INTENSIVE SHED OR PEN FOR 85 TO 100 BIRDS

(20 feet long by 17 feet deep, 7 feet 6 inches high in front, 6 feet 6 inches high at back)

Sheds of this type (with desirable roof height for summer or winter) have been used with successful results. As intensive sheds they can hold up to 100 White Leghorns in low-rainfall areas, and up to 85 to 90 heavy breeds and in heavy-rainfall areas 85 White Leghorns and 70 to 75 heavy breeds. The normal direction to face the shed is north. Some of the main features are as follows. The roof is overhung in front nearly 3 feet. The front opening is 4 feet above the 3 feet 6 inches high iron front. A piece of iron from the front of the overhang down to the top of the front iron at the shed corners is a worthwhile precaution, as the overhang is not effective at that point. (This is an advantage with all sheds.) This shed has been used as a semi-intensive shed, and few more birds carried, but is not recommended. The side doors should be set 9 or 10 inches above floor-level in view of the build-up that occurs with deep litter. This applies with all deep-litter sheds. The rear door can be set to swing outwards or inwards as desired. If outwards, netting is secured inside—if inwards, the reverse. This door is not normally used for access, but for ventilation purposes in heat-waves. If desired a small inner wire-netting door can be used. The floor can be of concrete (details given later) or the shed can be used with an earth floor—provided floor-level is well above the surrounding ground-line, and reasonable drainage facilities exist outside the shed.

Roosts are normally located in the rear western quarter of the shed, set about 2 feet to 2 feet 6 inches above floor-level (allowing for deep-litter build-up). Nests can be as discussed in Chapter 16. Ventilation can come either from a 6 but preferably 12-inch opening along the back of the shed, or from a baffle ventilator. Refer to *Fig. 105* for details of this type.

DRYDEN TYPE SHED ADAPTATION

(See also Figs 104 and 106)

Poultry sheds in Australia were formerly closed up too much — comfort of the operator was the guide rather than the needs of the bird Experimental work was undertaken to incorporate advanced designs with better ventilation, but without increasing costs The main lead was taken from California, U S A Trials have been successfully carried out to incorporate these principles by a simple alteration to the back of the shed on the lines of the University of California Dryden type shed *(Fig 104)*

The results have been very encouraging indeed and this design is

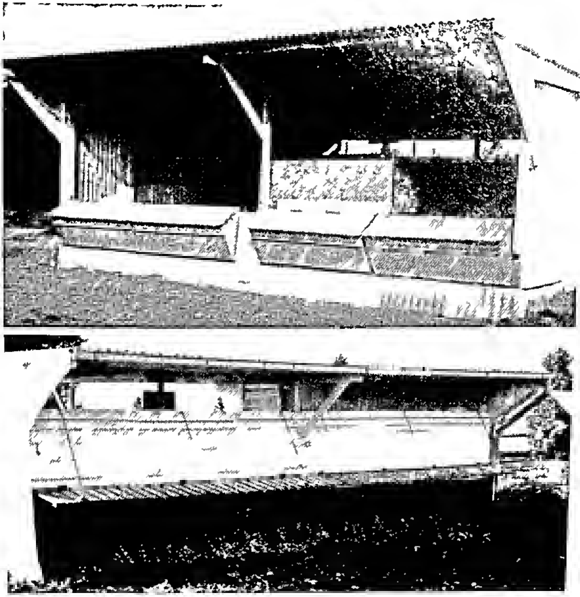
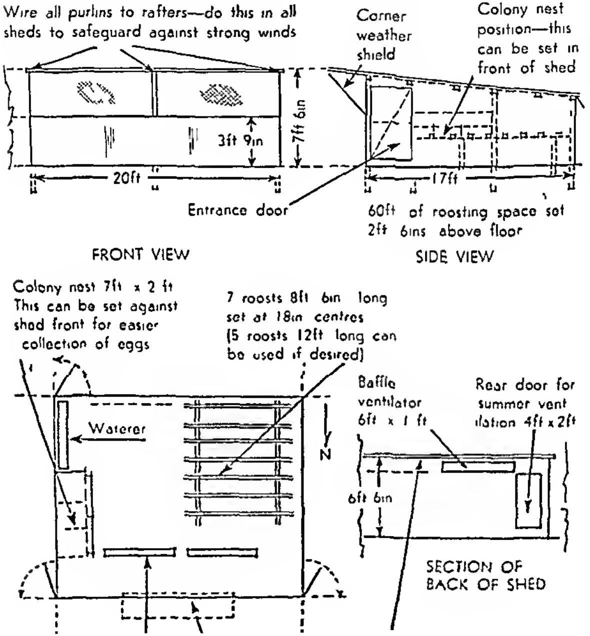


Fig 104 Orthodox lean to shed 20 ft x 17 ft adapted to make a Dryden type shed This increased its capacity from 85 to 100 birds Ventilation is improved, eggs are cleaner and higher lay obtained See also Fig 106 The front view shows outside feeders Roof overhang protects front Note corner shields and centre piece of timber The back view shows the roof overhang the protection behind the roosts as the only solid portion and entirely open under the roosts

recommended for high efficiency of operation and lowered costs. (See p 236) The increased ventilation has resulted in all round improvement with excellent litter condition without stirring being needed, also eggs are consistently very much "cleaner from nest" than in other type sheds, aided by the night droppings falling outside the litter area (This means less deep litter area and for developing areas, where deep litter as fertilizer is very valuable, similar design for ventilation, but with full floor area, is suggested See *Fig 92*, and Appendix 2, for further information)



The "controlled" ventilation with adequate air flow (birds, protected by the solid portion immediately behind them, roost over open space) prevented respiratory problems and resulted in a more even s ed temperature

Summer temperatures in the shed range about 5°F lower, and on frosty nights readings have been about 2°F higher, than in the orthodox type sheds Laying results have been better (about 1 dozen more eggs) in winter period and feed consumption less (about ½ lb feed less per dozen eggs) than in orthodox sheds The number of birds can be increased by 15 to 20 per cent (up to 120 birds)—*with* extra roosting, feeder, and water space given Also culling is easy with no roost problem in this type shed

This design is well suited to high temperature and monsoon climate areas (In built-up areas check, as with cages, for fly control in the roosting section, but experience has indicated good "coning" with 12 month droppings accumulation)

The adaptation of the shed is not difficult Alteration is as follows

- The bottom 3 feet at the back of the shed is left open—the next 2 feet above this is closed with solid material e g galvanized corrugated iron on edge—then the remaining 15 inches to top back rail is closed with netting (to stop birds flying out) This applies right along the back of the shed The roof is then extended to give an overhang at the back of about 2 feet This protects the top opening, preventing rain driving onto the birds on the roosts

- An inner wall or division 2 feet 6 inches high (can be all solid or up to 18 inches only, the balance with adjustable 12 inch flap to be removed or lowered in very hot weather—with netting behind the flap area) is set 4 feet in from the back of the shed

- Two inch mesh wire netting is then tacked on top of this and across to the rail at a 3-feet level at the back of the shed The 4 feet long roosts at 16 inch centres are then placed on this running north and south Secure with locking pins The droppings cone up under the roosts, and cleaning is done from outside the shed

- The front of the shed can remain as usual (and inside hoppers used) or be replaced by feed hoppers filled from the outside This gives enough feed space for the shed with the feeding lip inside the shed—provided the hoppers fill the entire front of the shed This would close the front to about 2 feet in height and works quite satisfactorily

Note An adaptation similar in all respects can be made at the rear of the 80 feet x 17 feet shed used intensively The small 12 bird 8 feet x 6 feet pens described (pp 240 50) in this chapter can be adapted, as described p 250, in similar fashion (by adjusting in proportion—as with any "lean to" shed) Water is provided by a 6-foot long waterer set about 15 inches above ground level—not above litter This is best set on a grill just outside edge (or back) of shed (See Fig 106) In a row of Dryden type pens, place waterers at rear of roosting area Birds drink through openings while standing on roosts See Fig 109 for details of suitable type which can be adapted

Costs for Shed 20 feet by 17 feet, 7 feet 6 inches high in front and 6 feet 6 inches high at back

		Approx. cost
Roof covering—(nearly 3-foot overhang in front), 50 sq. yds covering		
If corrugated asbestos @ 60c. per sq. yd	\$30	Average (1) \$30
If galv. cor. iron ap. 4 cwt @ \$150 per ton (20—7-fts and 10—8-fts using 2—7-fts and 1—8-ft in line) ..	\$30	
Covering for back, 2 sides and front, 60 sq. yds covering		
If flat asbestos @ 40c. per sq. yd	\$24	Average (2) \$30
If galv. cor. iron ap. 5 cwt @ \$150 per ton (10—7-fts back; 10—5-fts for front closed up 4 ft, and 10—8-fts, 10—7-fts for sides, including doors, one at each side of shed and one at back for hot weather)	\$37.50	

	Approx. super feet
Softwood:	
Purlins: (3 ft 3 ins between centres) 7—20-fts x 3″ x 2″ for iron (4″ x 2″ if asbestos used)	70
Rafters: (10 ft apart) 3—20-fts 4″ x 2″ (side rafters and centre rafter supported by post at the middle)	45
Side rails: 4—17-fts x 3″ x 2″ (2 on each side approx. 1 ft and 4 ft above floor-level)	35
Back and front: 5 rails 20 ft x 3″ x 2″ (3 at back and 2 in front), set 1 ft and 4 ft above floor level and at back extra rail at top underneath ventilator gap	50
Roosts: 7—8½-fts x 3″ x 2″, set with last roost 1 ft from back wall and 18-inch centres. 2—10-fts x 4″ x 2″ bearers to carry roosts. Roost-level 2 ft to 2 ft 6 ins above floor	40
3 *Doors*: 60 ft x 3″ x 2″, one each side close to front each 6 ft x 3 ft (22 ft per door) and 1 door 5 ft x 2 ft in back (16 ft)	30
Frame for adjustable baffle ventilator if used (refer text) and nest rails and supports (40 ft 3″ x 2″). Landing rail 8 ft x 3″ x 1″ and some spare timber	25
Netting door (inside door on side to allow additional ventilation in hot weather) 21 ft x 3″ x 1″	5
Hardwood:	
12 posts with average length 8½ ft x 3″ x 3″. One post half-way on sides, back and front—plus extra post at side of each door and one in middle of shed (3—9-fts, 3—8½-fts, 6—8-fts 102 ft x 3″ x 3″)	75
TOTAL	375 super feet
	(3)
If available @ \$10 per 100 super feet	\$37.50
Sundries:	
Netting for front of shed, inner netting, door and inside back door opening. Hinges, screws, nails, tie-wire, etc. = Approx. \$10	
Suggested Total Cost for Shed (without floor)	\$107.50
Floor estimate:	
If ½ load sand \$4; ½ load screenings \$6 and 14 to 15 bags cement @ \$1.50, \$22.50	\$33.50
COMBINED COST approximately	\$140

Saving on a Row of Sheds

When building a row of pens the saving would be one side when two sheds are joined with solid divisions (i e two pens each 20 feet by 17 feet, and two sides when joined to form one large pen (i e 40 feet by 17 feet)

The quantity of material saved and the suggested cost would be

For one side:

Covering material—15½ sq yds (approx ¼ of total on walls)	$8
Timber—4 posts (25 super feet) 2—17-ft rails (17 super ft) 1—20 ft rafter (12 super feet) 1 door (11 super feet) Approx total of 65 super feet of timber	$6 50
Share of sundries	$1 50
Estimated saving per side	$16

Note This would reduce costs per bird from $1 40 to $1 65 as above to $1 25 to $1 50 per bird at 3 4 to 4 square feet per bird

Joining two pens with a solid division would save $16 on cost of two separate pens, and making one large pen 40 feet by 17 feet would save $32 (Similar proportional savings would apply—of either type—for 20 feet x 20 feet pens on p 236) When building a row of pens of this type, the inner communication door should never be omitted—it greatly facilitates routine operations

Note It is suggested that 40 feet be the maximum length without a solid division with these pens

Costs and Items Involved with Dryden Adaptation

(See *Figs 104* and *106*) (Refer to costs listed pp 234-5 for bas s)

Roof—Extra 2 feet overhang at back—no extra cost for iron—this is taken from saving on material at back of shed

Inner wall—2 feet 6 inches high No extra iron needed (or asbestos if used) This is also taken from back of shed—(as only 2 feet closed instead of approximately 6 feet in orthodox shed)

Note—If feeders used along front of shed then a saving of nearly all the front is made (only 1 foot under feeder needed) (3½ square yards saved value approximately $2)—as the back material is sufficient for roof extension and inner wall above

Roosts—No extra required as 15 roosts 4 ft long same length of timber *except* if 120 birds housed, and large type birds, then advised use extra 7½ ft timber on roosts by bringing inner wall in 4 feet 6 inches from back, also in this case *waterer* made 8 ft long and 2 small hanging *feeders* advised for inside shed (as additional to front feeders—of type used in griller sheds)

Timber—The timber provided for the back, is sufficient for the solid portion (2 rails used) and the other rail for top of the inner wall—the bottom can be set in the concrete The front rails are used for support above and below feeder if these used in front (Timber saved on small

doors at rear approximately 13 super feet and bearers for roosts not needed (as carried on rear rail and top of inner wall)—saves further 7 super feet = 20 super feet saved value approximately $2)

Extra 2 inch mesh netting required—Front 20 feet x 2 feet *Under roosts* 20 feet x 4 feet *Back under roof* 20 feet x 1½ feet This is equivalent to 8¼ yards 72 inch x 2 inch mesh netting Value approximately $1 67, but $4 savings listed above This indicates a total saving of nearly $2 50 when adapting a shed (and this amount would approximately cover slats *if* needed at rear in some locations)

Accordingly, no extra cost is involved but savings made with a shed, and this alteration—with its many benefits as listed, plus increased capacity giving lowered cost per bird housed (See also Appendix 2)

Costs for Shed 20 feet by 20 feet

The increase in material on that given for the 20-foot by 17-foot (with no variation for orthodox or Dryden sheds) involves the following

Extra covering material		
Roof—extra 3 ft x 20 ft (60 sq ft), 7 sq yds if asbestos cor @ 60c (and equivalent cost for iron)	$4 20	
Sides—7 ft x 3 ft for 2 sides (42 sq ft or 4⅔ sq yds) if asbestos flat @ 40c	$1 80	$6 00 or
If all iron 12 sq yds ap 1 cwt @ $150 per ton		$7 50
Extra timber		
Roof—extra purlin 20 ft 3″ x 2″ (10 super feet), extra 3 ft on 3 rafters 4″ x 2″ (9 ft)	6 super feet	
Sides—extra 3 ft on 4 rails 12 ft 3″ x 2″	6 super feet	
	22 super feet	
If at $10 00 per 100 super feet .. .		$2 20
Increase involved approx $8 *to* $10		

Thus an increase of 17 per cent in space is obtained on increasing the cost by $8 to $10 approximately 8 per cent This means 20 ft by 17 ft (340 sq ft) for $108 and 20 ft by 20 ft (400 sq ft) for $116 to $118 (exclusive of floors)

This would gain one pen in six at approximately half a pen cost—or nearly 12c per bird less

OTHER ADAPTATIONS OF THIS SHED

This type of shed can be adapted to form two pens for 50 birds or used as a free range shed for 350 birds A brief description will be given Structural features are practically the same, the main alterations being a possible rearrangement of roosts, feeders, and the nests

As Two Pens with Approximately 50 Birds in Each

This is a means of increasing output of eggs per bird without greatly increasing labour Three years of trials with White Leghorns in 100-bird pens compared with 50 birds in subdivided pens under identical cor-

ditions of feeding, hatching, and strains (only differing in number per pen) gave an average increased lay of 11 eggs per bird for the 50-bird pen

A feature noticed in smaller pens has been a low incidence of respiratory problems. High performance is attained with large pens, but results are often less consistent than with smaller groups Further reference is made later in this chapter.

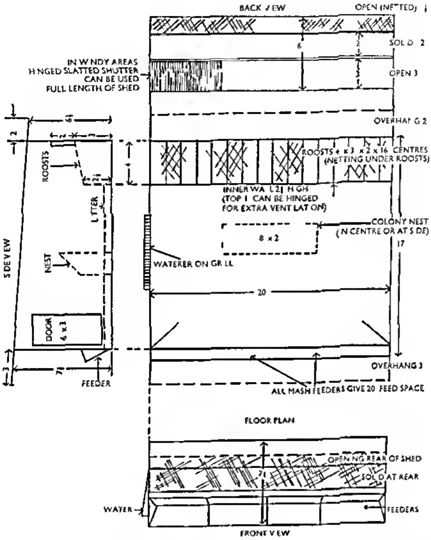


Fig. 106 Lean-to shed adapted to Dryden principle, with increased ventilation. Droppings from birds roosting at night fall outside litter area Ventilation for summer and winter is constant (except in windy, cold areas where a baffle of slats may be used to protect opening at back of shed) See also Appendix 2

The adaptation of the pen for 50 birds each side is made as follows:

1. The pen is divided by wire-netting through the middle, making two pens 10 feet by 17 feet (or 10 feet by 20 feet) and a wire-netting door is put in the division near the front of the shed for communication.

2. The ventilation arrangements work out quite well with the opening right along the back. The birds in the eastern side have the small door in back against the outside, and the birds in the western pen have the ground-level door in the side near the front. (The Dryden Shed is uniform for both pens)

3. Roosts should be set at the centre of the rear of the pen, half each side of the division. (No alteration required in the Dryden type.)

4. The waterer can be set to serve both pens and also the feeder if desired. (If feeder along front and waterer at back as in Dryden shed, no alteration.)

5. Nests are divided half in each pen—one lot on eastern and other on western wall or nests in centre, half each side of the division.

Involves alteration of internal items only—Dryden type easily subdivided.

As Free-range Roosting-shed for 350 Birds

The orthodox shed only is satisfactory for this purpose, for a sideline unit, and could be used intensively at some future time by altering internal fitments.

The adaptation is made as follows:

1. The roosting required will be 190 to 210 feet: 10 roosts each 20 feet long in the 20-foot by 17-foot shed for 350 White Leghorns; but for heavy breeds the 20-foot by 20-foot shed should be used with 11 roosts each 20 feet long. These would be started 10 inches from rear of shed, and at 16-inch centres for White Leghorns would occupy approximately 13 feet of the shed (leaving 4 feet in front). With heavy breeds at 17- to 18-inch centres, and eleven roosts, a depth of approximately 16 feet would be taken up (leaving 4 feet in front).

2. Nesting requirements would be best met by three colony nests along front or back of shed. (The difficulties attendant upon collection of eggs from free-range sheds would be unavoidable.) Collection would be easier with the colony nests set in the front, as the eggs could be collected from under cover of the overhang, in front of shed. It could be arranged to collect the eggs inside from the space of approximately 4 feet left in front of the roosts. This would mean flaps to be lifted inside—the flaps could have the entrance holes in them. Alternatively, kerosene-tin type nests could be used inside the front of the shed—forty nests in two tiers would suffice, taking up a space of 15 feet by 1½ feet. This would allow approximately a 3-foot passage between these nests and the roosts. It is also possible to have the colony nests inside front of shed with slides for collecting from outside. These are some alternative suggestions for nesting that can be used as desired.

3. When the shed is used in this way the ventilation gap should be about 8 to 12 inches at the rear to make allowance for hot weather. Keep this as wide as possible: it is easy to adjust openings with a hinged shutter (but do not close right up at any time), but very difficult to increase an opening when the shed is built.

4. Water can be set along the front of the shed suitably shaded and available from inside (and outside as well for preference). Otherwise have it very close to the shed, with ample shade.

5. Feeding would have to be in weatherproof hoppers outside or wet-mash troughs. (Some operators have brush or roof-only type shelters over hoppers and also for waterers for free-range stock—a sound practice.)

This system is a further modification of the free-range system discussed earlier in this chapter, and can be considered in conjunction with the earlier remarks. (For further details check *Fig. 107* below.)

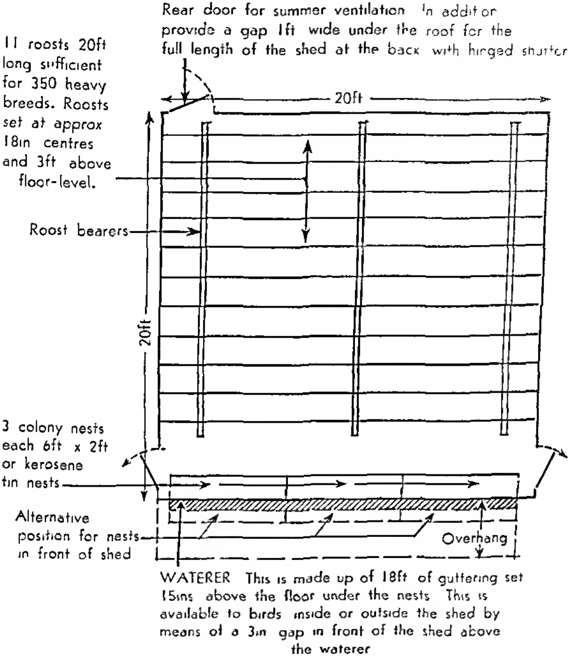


Fig. 107. *Floor plan of 20′ x 20′ shed adapted as free-range roosting quarters* for 350 birds. General details as for intensive shed, but altered internal set-up as shown.

INTENSIVE UNITS FOR 40 BIRDS

Excellent production results, from unculled stock selected from hatcheries at day-old stage (mid-August hatching), have been obtained at Hawkesbury College random sample tests, New South Wales. These groups of 40 pullets were raised intensively, and housed and tested as layers in these pens. (Rearing results have been excellent: for example under 2 per cent loss to sixteen weeks in 1959-61 test, showing the value of good husbandry and ample room.) The laying results have been in the

vicinity of 200 and over eggs per bird in the better groups from first egg laid to 16th March the following year—approximately fourteen months—and the production for all birds (under unlighted conditions) has been over 46 per cent for the winter period 1st April to 31st July (Mortality as low as 7 5 per cent was recorded for the winning group in 1953-5 test with a production of 244 per bird) The general results were excellent, particularly in view of the no culling condition in an official group test These tests have been reported in various articles by V H Brann, Principal Livestock Officer (Poultry) and S J Wilkins and J H Gulliford, Livestock Officers (Poultry) of the New South Wales Department of Agriculture (The article by S J Wilkins, "Housing Layers in Small Units", gave an itemized account of materials used in the construction of these pens) (For feeding rations used see p 305) Also, in 40 bird Dryden type pens (described below) hatchery crossbreds in the 1962 3 Random Sample Test in South Australia, averaged 50 76 eggs per bird (hen housed lay and under unlighted conditions) to May 31st—from September 21st hatchings They used only 3 98 lb feed per dozen eggs produced The feeding was the high energy all-mash ration listed on p 313 Leading groups exceeded 240 eggs for 12 months' lay The entries were reared in these pens with under 4 per cent loss in laying stage—feeding was with high energy all mash ration, p 306

Details of 40 bird Dryden type pens

These pens are similar to the Dryden plan (Fig 106) on p 236, but have been reduced in size proportionately Each pen is 13 feet long by 12 feet deep, 7 feet high in front and 6 feet high at back The roof overhangs 2 feet 6 inches in front, and 2 feet at back The roosting portion has the inner wall, which is 2 feet 3 inches high, set in 3 feet from back wall The only alteration at back is that the opening at ground level is reduced to 2 feet *6 inches—remainder as for Fig 106 Nine roosts each 3 feet long are used*—spaced 17 inch centres Same proviso for slats at rear opening—only needed in exposed windy and cold areas Water to suit a row of pens can also be placed at rear of pen above roosts—when front of shed composed of 9 feet of feeder space—plus entry door (Communicating doors between pens can be used) One colony nest at centre of pen or side If waterer placed in front then use 2 griller type hanging feeders Suitable up to 50 layers—or subdivide for 2 pens of 20 to 25

The results obtained indicate, as with the 50 bird pens listed previously, that more eggs can be obtained per bird than in the larger units with a low incidence of mortality under normal conditions ('Nature does not like crowds ") Labour requirements are not high when all-mash feeding and deep litter usage are adopted, and culling is easier in small units These points merit serious consideration in relation to production efficiency

SMALL-PEN UNITS FOR 12 BIRDS

In Chapter 4 the lay out is given for a farm using 12 bird pens Results obtained in units of this type are outstanding In the 1956-8 official egg to layer test at Parafield Poultry Station, Department of Agriculture, South Australia, leading groups gave up to 250 hen housed and 250

monthly average per bird in fifty weeks The average for all entries of all crossbred samples of hatchery stock over 4 years was 201 hen housed and 222 monthly average per bird with fifty-week testing period Crossbreds in 1960-1 Random Sample Tests averaged over 190 hen housed lay in 9½ months—yearly equivalent 243 rate of lay (Hen housed is total eggs divided by all birds starting test and monthly average is based on monthly total of eggs divided by birds alive in pen for the month)

These results have been confirmed by trials on the Station over seven years Pullets in these small units, of the same strain and hatching and under uniform handling and feeding methods, consistently gave averages ranging around 25 to 30 eggs more per bird than in 100 bird units Colds were not experienced in these pens and mortality was very low Winter production figures have been excellent The random test egg to layer birds (all breeds) averaged 60 per cent in the 1957-9 test with all crossbreds averaging 72 per cent for the winter test period April 1st to July 31st, and all crossbreds in 1960-1 R S T averaged 64 per cent lay from March 1st to June 30th under unlighted conditions

Reference has been made to some general features and experiences in Chapter 4 under Intensive Farm with Small-pen Units These pens are also suitable as breeding pens on a single-unit basis, and also for progeny testing of pullets from half sister families They operate best as intensive units for labour efficiency (See adaptation for gable design in Appendix 1)

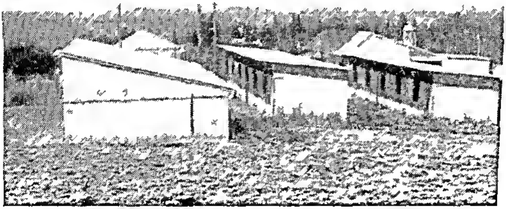


Fig 108 Section of a farm with small pen units in a rainfall area of over 50 inches Five year average winter production of over 60 per cent has been maintained, and annual lay per head is excellent Adaptations can reduce labour requirements

Labour Factor with Small Units

The natural reaction when small pens are mentioned is to consider the labour involved This can be reduced to a minimum, and operating time made comparable that of large pens and cages by means of the following practices

1 *Water supply* by automatic methods means no more attention for this than in big pens—a long line of guttering at the rear is one of the

easiest watering methods. Ample volume of water is important to birds, and this is an easy way of achieving it. The 12 birds* drink through two holes 12 inches by 3 inches cut in the iron or asbestos at the back. These openings are also made to serve for ventilation in hot weather by "hooking" the cover board on the trough to hold it in a horizontal position. (It is recommended that this 3-inch opening extend right across the pen as a further safeguard against hot weather problems.) Water is still shaded, but a current of air flows through at "bird-level" as well as through the 6- to 12-inch opening under the roof at the back of their pen. This also improves litter condition. (Other watering systems can be used, but they must be automatic.)

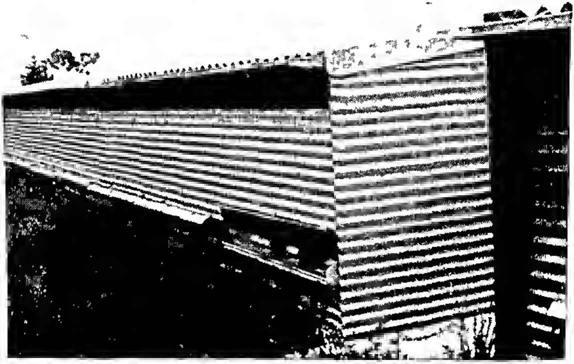


Fig. 109. Watering arrangements, showing cover board and openings for drinking and floor ventilation. There is a ventilation opening under roof. Lucerne growing between pens aids in cooling sheds. No losses occurred in these pens with shade temperature readings reaching 110°F.

2. *Feeding* can be with a dry- or all-mash hopper set in front of pen (replenishment once weekly means a very low total labour requirement). Alternatively use a double-sided hopper in the division between each two pens or a hanging feeder in each pen. If wet mash is employed an opening can be provided through which birds put their heads to eat the mash from guttering set outside. Alternatively use a feeder inside the front and wet mash is dropped through an open-topped small chute in front of the pen. (Note photograph of a group of these pens with this adaptation.) Grain can be thrown from a small scoop through a hole cut in the upper part of the door. (This will not be needed if all mash is fed.) No yards are attached,

* It is practicable to start these pens with 14 pullets (medium size) to allow for light culling and still have pens used to economic advantage. The space is sufficient. With Dryden type adaptation (see p. 250) 16 pullets can be used.

as the labour factor is very heavy when going through the doors of narrow yards Intensive units allow feeding to be carried out in a straight line from pen to pen, which is an efficient method, and no labour of entering doors is involved A distance of only six inches per bird is travelled from pen to pen with these units In hot areas the provision of the front opening right across the pen and under the door (3 inches wide) can be made to assist in keeping conditions cooler See *Fig 112 2* on page 250 (Refer to pp 233-7 for adaptation to Dryden shedding with alternative ventilation system)

Fig 110 Labour saving nesting on small units Eggs can be collected from outside through the slides with baskets or trolley wheeled on concrete path in front of pens The chutes can be used for greenfeed All mash hoppers in the divisions serve 2 pens or a hanging feeder is used They are re filled weekly

3 *Collecting eggs* can be carried out conveniently, as small colony type nests can be set in the front of the shed (at convenient height for collection) protected by the overhang in front of the pens, which is also a protection for the operator The lid is lifted for collecting the eggs Alternatively (and this can mean cooler eggs and save an extra roof overhang in front) the nests can be set *inside* the pen at the corresponding height and a small slide can be pushed up or aside to collect the eggs If corrugated galvanized iron is used in front of pen, a simple slide can be made by cutting the hole desired (about 8 inches by 12 inches is ample) and turning and smoothing the edges to prevent cutting a finger or hand Then take a piece of corru gated iron slightly wider and longer than the opening and set it as a slide, guided by corrugations It can be kept in position by a piece of 2 inch by 1-inch secured inside the shed with the two bolts or nails holding it set just outside the edge of the slide, and a small piece of 2 inch by 1 inch in front

near the bottom of the slide will act as a "knob" to hold when working the slide Either of these methods can be used Alternatively, with flat iron or asbestos in front a slide running in metal grooves can be moved sideways Also, a suspended circle of flat iron set in front of a hole can be easily moved aside for egg collection from the nest inside Entry to pens may be necessary on occasions to collect the odd egg or two that may be laid on the litter The use of suitable nest material (not cold as with sand or shellgrit for winter) will help greatly in preventing this—clean rice hulls or shavings can be used in these nests This makes them comfortable and induces the birds to lay in the nests This applies particularly in cold weather (Breed factors are involved also—crossbreds and White Leghorns can be expected to give very little trouble)

4 *Cleaning* is only an annual task and presents no more problems than with big sheds The distance to move the litter when cleaning out is less than from the back of large pens Doors can be set to open inward or outward Also with outside feeding and egg collection, routine labour is congenial Correctly maintained, general surroundings are very sanitary and free from smells and fly populations

5 *Health* of well reared birds is excellent, no trouble being experienced with colds, and mortality rates being very low Little culling is necessary during the year, as bullying (due to the 'social level' with birds) is reduced to a minimum Any birds that do break down can be easily culled when in small groups Birds like some company, particularly in cold weather, and small groups allow sufficient without reduction in lay because of crowding The use of deep litter provides occupation, and reduces vices to a minimum

Comment The general points outlined in relation to water, feeding, egg collection, and cleaning indicate that these pens can be handled with low-level labour requirement, and in view of high rate of lay per bird giving low usage of feed per dozen eggs produced can be given serious consideration from a commercial viewpoint These pens are suited to all areas, giving good winter or summer conditions for the birds The extremely high level production obtained indicates that small units can hold their own with any type of housing for poultry, as an overall economic system

General Details of Small pen Units for 12 Birds

The pens are 8 feet deep by 6 feet wide (for low labour needs) They are 6 feet high in front and 5 feet at back (This can be increased by 6 inches front and back if desired, but these heights have given excellent results) The front door is 5 feet by 2 feet 6 inches (or 2 feet) and allows for 1 foot under door, and the lower 2 feet is covered with flat or corrugated iron Remainder of pen in front is closed up to within 18 inches or 3 feet of the roof according to the locality—the lower height for warmer areas Alternatively front of pen and iron on door can be covered to same level and leave approximately 2 feet 6 inches open An overhang of 2 feet 6 inches is advisable for protection when feeding, collecting eggs, or cleaning, if nests are set out in front of pen Less is needed when nests are set inside The watering system (as referred to before) is 4 inch D

guttering or other type waterers at the rear of the pen with a cover board for shade Sides are solid, but when built in line every second division is normally closed up to the level of the rear of the pen (4 feet 6 inches) Alternatively, in areas with medium rainfall, every third division can be solid and netting used between The opening at back under roof is usually about 6 inches, but this should be increased in hot areas to 12 inches to be opened up as required Provide sufficient ventilation at all

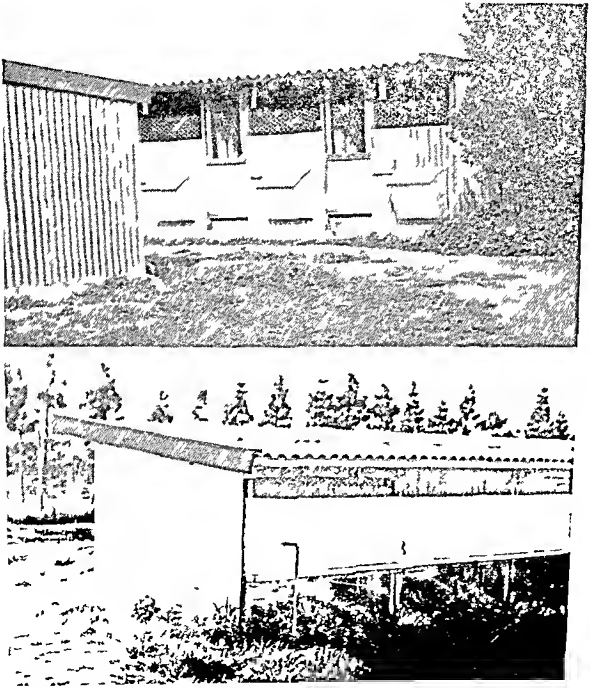


Fig 111 Small unit pens each 8 ft x 6 ft, adapted to make Dryden type units Front view indicates outside feeders and slides can be seen for egg collection from nests inside the pen front Rear view shows the solid portion behind the roosts ventilation over and under roosts, and overhang of roof

times With high temperatures raise the lids of the nests slightly (or if slides are used in front leave these slightly open—sufficient for ventilation, but not for birds to get out) As many pens as desired can be built in line * When building more than one row, allow 10 to 12 feet between rows to allow passage of a handcart or a truck This facilitates moving in stock, culling work, and cleaning A concrete pathway in front will help routine work, and also allow use of a suitable rubber-tyred cart for egg collection

The floor, as for other intensive units, can be of concrete† or earth (with the usual proviso that floor must be higher than surrounding ground level) One roost 7 feet long is sufficient, set 18 inches to 2 feet above the floor (This contributes to good results, as ventilation is less of a problem with a single roost)

Costs for 12-bird Units

Light materials can be used in these pens because of their small span Design and dimensions are such that prefabrication with timber or metal framing is comparatively simple

Roof covering (with 2 ft 6 in overhang)		
7 sq yds if corrugated asbestos used @ 60c sq yd	$4 20	
If desiring to use single 10 ft sheets then overhang will be reduced to approx 18 ins The protection of the operator is the main purpose—in this case set the nests inside with front opening and slide This would reduce to 6½ sq yds	$3 90	Average (1) $4 00
If corrugated galvanized iron used (ap ½ cwt) @ $150 per ton	$3 90	
3—10-ft sheets could be used as above for 10 ft corrugated asbestos, if 3—5 fts and 3—6 fts used to give full overhang then cost	$4 10	
Covering for 2 sides, back and front		
Approx 15 sq yds covering when a single pen is constructed		
If flat asbestos @ 40c per sq yd	$6 00	
If galv cor iron @ $150 per ton approx (a saving could be made in small pens if flat iron used) (3—5 fts for back, 2½—5 fts for front, 8—6-fts for sides for a single pen) (but less when 2 pens used)	$9 00	Average (2) $7 50

Softwood	*Approx super feet*
Purlins—(this item can be varied)— 4—6-fts 3" x 2" 4 purlins are used when carried to full 2 ft 6-in overhang, but 3 will suffice if only 18 inch overhang, 3—6-fts 3" x 2" (the purlin at back post and front post to be bolted at top)	12

* To convert to Dryden type units see p 231 for details of benefits, and pp 237 and 250 for constructional points This type unit increases efficiency and bird capacity

† Concrete floors would cost approximately $4 80 for a pen 8 feet by 6 feet (about 10c per square foot for materials)

Rafters—2 only required—supported by outer iron, hence 3 x 2" sufficient, 2—11 fts 3" x 2"		11
Side rails one to each side 2" x 2" sufficient—16 ft 2 x 2		5
Back and front rails—2—6 fts at back 1—6 ft 3" x 2 and 1—6 ft 2" x 2" (lower rail) Front—1 piece 3½ ft long top front 1 piece 3 ft long under door near floor and 1 piece 6 ft long to go right across pen under the door (12 ft 2 x 2")		9
Front door—4 ft 9 ins or 5 ft x 2 ft 6 ins (closed up underneath door for 9 ins or up to 12 ins) 18 ft 3" x 1" (Note—a 2 ft-wide door could be used to allow more space for feeder and nest)	app	5
Roost—1 length 7 ft x 2" x 2", in addition 6 ft 2" x 1½" hardwood supports (or piping)	app	4
Posts—(hardwood) 5 required 3—7 ft 6 ins for front (2—3" x 2" and 1 at centre 2" x 2") and 2—6 ft 6 ins 3" x 2 for back, making 33 ft 3" x 2"	app	16
		62
		(3)
If available $10 per 100 super feet		$6 20
Sundries.		(4)
Netting, ventilation board, nails, screws, hinges, etc		$1 40
Combined costs of (1), (2), (3), and (4) (on this basis for *one pen* (without floor))		$19 10 per pen

Cost of one side—for calculating savings with more than one pen

5 sq yds covering materials at average rate shown above of 50c per sq yd	$2 50
1 rafter (1—11 ft 3" x 2") and 1 side rail (8 ft x 3" x 2"), making 10 super feet @ $10 per 100 super feet	$1
Share of sundries	25c
	$3 75

When two pens are built together the saving is the cost of 1 side plus ½ of other side covering (as division between each two pens only taken to 4 to 4½ feet) approximate savings $4 25

Therefore cost of *two pens* (without floor) = approx $34 = $17 *per pen*

In suitable mild climates, three pens may be built together with wire-netting division, the cost being reduced to $14 50 per pen To convert to *Dryden type units* see pp 235-6 for comparisons indicating cost reduction These apply in proportion for these pens also See also p 250 for details of alterations

Some operators have made the pens 8 feet by 8 feet with quite good laying results One division of the usual construction is eliminated by reducing four pens 6 feet by 8 feet to three pens 8 feet by 8 feet The result is a reduction of approximately $4 25, representing approximately 8c per bird on capital cost

These figures can be compared, using the same cost basis for materials, and the same floor area per bird, with the 20 foot by 17 foot units Cost per bird is *approximately* $1 30 to $1 50 in the large pens, $1 20 to $1 50

in 8 foot by 6 foot units, according to type of division used and bird numbers in the pens * This is practically the same cost In view of the greater efficiency with small flocks, and particularly with the 8-foot by 6 foot units (better health, trials giving an average increase of up to 30 eggs per bird, and reasonable labour requirements†) serious consideration should be given to the smaller unit of this type on commercial farms as a means of increasing production per bird

Conclusions The examples for the 50-bird, 40 bird, and 12-bird units all show a rise in the average production per layer as compared with large pens It is also significant that these results in more than one State have been as good as or better than with single-pen units It is possible to handle a large number of birds per operator by making use of smaller units of the types described and proved highly efficient The use of smaller groups is a sound economic proposition

LAYING CAGES

Introduction to laying cage management was given pp 57-61, Chapter 4 Production in laying cages can be kept at a high level by means of a ration specifically balanced for this purpose, correct management for extremes of temperature, ventilation control, and routine attention Refer to Chapter 14 for a suitable battery-cage all-mash ration (Mash grain feeding can also be used) A dominant factor in ensuring high production is that stressed for the 12- to 50-bird pens—a reduction in numbers per unit When birds are in single units as compared with "doubles" or "trios" there is no bullying or fighting—the social level does not exist as a handicap—though birds from the same rearing groups are best placed in cages alongside one another for best results

A battery- or laying-cage unit can be handled in a limited area when houses of correct type are used, giving ample ventilation and light Three-tier cages in rows are used with movable trays or belts for clearing droppings, but single-tier open-shed types with droppings falling to the ground underneath have the lowest labour requirement and are the choice of most operators Disease problems are reduced, and incidence of respiratory troubles is low in good units There is no litter problem, and eggs are clean if the wires are kept clean, particularly in winter Culling is very easy in single cages, but birds should not be culled immediately on missing a few days, for it may be an ordinary pause

* If 14 medium sized pullets are started the housing cost is reduced to under $1 10 per bird, and if converted to Dryden type and 16 started, to $1 per bird.

† Another adaptation can be made to the front of these pens to further reduce labour Doors can be set at left and right of alternate pens A double sized nest inside with slide collection of eggs and double-sized feeder with outside filling can then be set at the division to serve both pens (with an inner division in the nest) The roost in each pen can be halved to form two roosts, one 12 inches from rear of pen, the other 18 inches in front of this Alternatively the roosts for the two pens can be set in this way, but through the division with half each side (For Dryden type units roosting portion presents no problem Other points as listed) This adaptation reduces labour on egg collection and feeding operations and is equivalent to handling a pen of 24 to 32 birds at each location Basic points are as set out in plans given for nest and feeder heights

possible with good layers. Testing work in connection with proving families by their progeny can be efficiently carried out. Cards marked while collecting, or pegs on the wire, or star counters are used to record the rate of lay. One small-scale test of battery laying cages (with White Leghorns) reported by the Department of Agriculture, South Australia, 1944-5, gave 55 per cent production for twelve months (198 eggs per bird

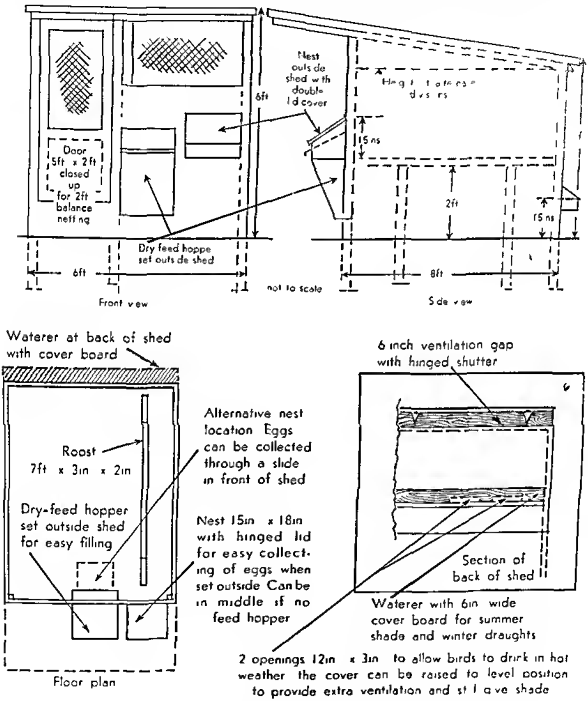


Fig. 112. 1. Small pens, 8 ft x 6 ft, showing details of equipment location, and provision made for water and ventilation. The ventilation can be increased with advantage in many areas, by making the top gap 9 inches; the shutter width is increased accordingly. The water opening of 3 inches width can be made to extend right across the pen. The increased ventilation gives improved summer cooling, and better deep-litter condition.

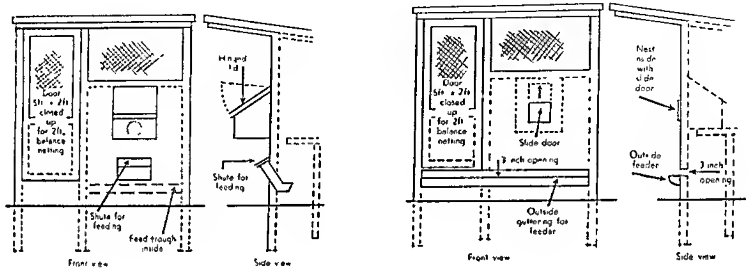


Fig. 112. 2. Small pens, 8 ft x 6 ft, as intensive units for 12 birds (up to 16 if adapted as Dryden unit). Some alternative arrangements are shown. The nest can be placed outside when sufficient roof overhang in front is provided, but the inside location is used when this is reduced, to avoid sunshine on the nest in hot weather.

The 3-inch opening shown in front of the shed can be used in very hot areas. It provides increased ventilation, and also allows ease of feeding chaffed greenfeed. It can be used for wet-mash feeding. Dry all mash can be given in pens with or without this opening with an outside feeder, or by using a hanging feeder inside the pen, or a double sided feeder set in the division between each two pens. It is also practicable to increase the front opening above the nest to 3 ft, and lower the nest accordingly.

Note: To adapt this pen to *Dryden type unit:* Check description on pp. 233 and 237 (also Fig. 111, p. 245) for background, and then adjust in proportion as follows. At back leave bottom 2 feet open, then have 2 feet closed, and remaining 9 inches netted. The inner wall to be 21 inches high, and set 2 feet in from back of shed. Four roosts, each 2 feet long, and set at 18 inch centres, are placed on netting to be fixed between the top of the inner wall, and the rail at 2 foot level at back. Roof to overhang 15 inches at back. All other pen fitments to be as for the ordinary type pen, except that the waterer can be placed at rear of pen above roosts. Guttering is described on p. 233, but small drinking cups can be used in a pipe line at back. (See also general comments in the text.)

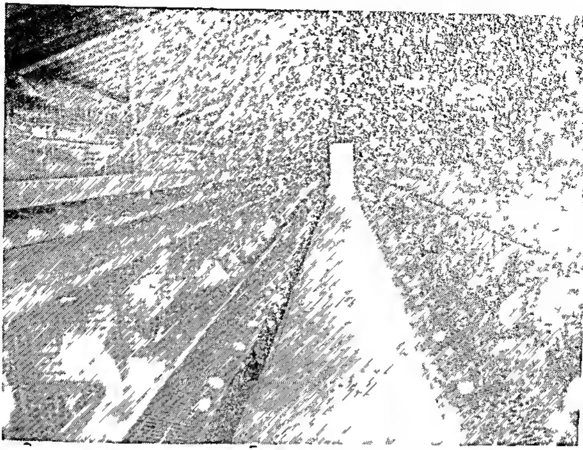


Fig 113 Californian-type laying cages, staggered and set on two levels These operate very well in suitable localities, particularly with birds in single cages Egg collection and other labour requirements are low, particularly when all cages are on one level Culling is very simple with one bird in each pen
—(*By courtesy of Multiplo Company*)

without culling) and 47 per cent production for the winter months (under unlighted conditions) The highest individual score was 245 eggs Feeding was wet mash and grain with choice of grits For saving of labour and high feed efficiency correctly balanced dry high-energy all mash is the method of choice today Broodiness is not a problem with heavy breeds or cross-breds in batteries Artificial lighting can be carried out night or morning, as no problems of finding roosts are involved Provision of light in the evening for feeding in hot weather can help production Second-year birds with lights can give a short term high lay for winter period Single pens are best with better laying, accurate culling on recorded basis, less call on husbandry skill, and reduced stress factors Small groups have been successful in batteries with approximately one square foot per bird in the cage The numbers of birds have ranged from three to five to thirty-five or more in colony cages

Feather-picking safeguards, such as debeaking, are necessary in these groups Management should be of a high standard with cage layers to cater for all requirements of the birds

Disadvantages are the high cost of battery cages and sheds Warm conditions and natural shelter, or suitably constructed shed sides, spaced palings or slats, and the use of single-tier batteries with simple shed structures, can reduce initial costs The number of slightly cracked eggs is higher than with floor units, and can be a problem in market

returns The gauge of wire on the floor is important also a cushion at end of floor, e g plastic, helps Depreciation is a much heavier item than with floor units Cost of replacement of stock is high Some of the very high figures cited for batteries are not based on a hen housed figure per bird, but the production per cage It is necessary to keep cages full in order to maintain high-level production Thus it is necessary to have a number of pullets being reared as replacement stock Some plants replace 90 to 120 per cent of the flock over the year, which means hatching every two or three months to keep the cages full Good management can be vital in reducing the need for this This need is influenced by the variation in egg prices over the year Further, egg prices throughout the year, and prices for cull birds, will decide whether the whole year or the winter period is the most important to returns Sanitation must be properly attended to Spraying cages at regular intervals is necessary Metal cages are not a complete safeguard against mites and lice, and as the birds cannot get away or "dust bath" the onus falls on the operator Flies are a major problem in closely populated areas Single bird cages and use of 'flame throwers", spraying, etc , and good conditions of ventilation to permit "coning up" of droppings under cages are necessary to avoid the fly problem and unsanitary conditions, otherwise cleaning out under single tier cages may be needed every few days in these areas It is also very important indeed that adequate air circulation be provided at ground level to dry the droppings Cut any weeds with scythe or mower or have lawns in between cage rows

Feed usage can be heavy (feed consumption is high and can be in the vicinity of 6 ounces per bird daily, but the energy level of the feed and low temperatures increasing maintenance needs are big factors in this) Also avoid waste, particularly from food being thrown on the floor or into the manure Every care must be taken to use well designed feeders, and not to fill these too full Replace feed frequently to prevent it from becoming stale Considerable care is needed in hot weather to avoid heavy mortality a spraying system will be necessary for heat waves, either with misting sprays direct on the birds or sprinklers on the roof Also lawn or lucerne in between rows or around sheds reduces reflected heat and temperatures Misting sprays use less water, but wet eggs and manure The sprinklers on the roof, particularly if used with asbestos covering, work very well

Success or failure with cages depends upon careful attention to the many items involved in management The operator requires a high standard of husbandry Labour needs may or may not be less than with birds on litter

Cage Rearing of Replacement Pullets

Rearing cages can be used to follow on the use of battery brooders, and battery weaners of the type referred to in Chapter 11 (p 189) They allow the use of a small area for the farm unit where pullets are reared and not purchased near laying stage Allow nearly two thirds of a square foot per pullet raised in the rearing cages They can occupy these from six or seven weeks up to fourteen or sixteen weeks Types referred to for cockerel rearing

nipple system and because of this in hot weather—*vide* low water pressure and heat problems—the trough system is recommended

With multiple cages room temperature should be held between 55°F and 80°F if possible and humidity in the vicinity of 50 to 65 per cent, ample ventilation helping to secure these conditions In Australia windows usually suffice but when hot conditions are experienced some sprinkler arrangement on the roof or misting sprays inside will be necessary Birds on wire in batteries or cages cannot withstand high temperatures (Birds on deep litter can cope with this much more efficiently)

The response to lighting by artificial means applies as for floor units with

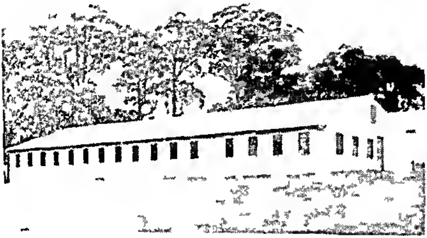
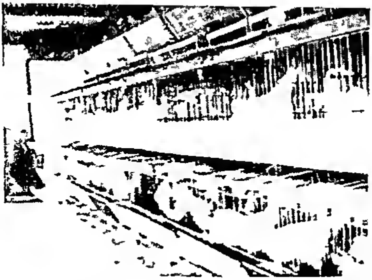
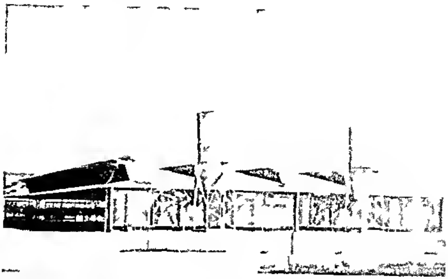


Fig 114 Battery cage installation in New South Wales

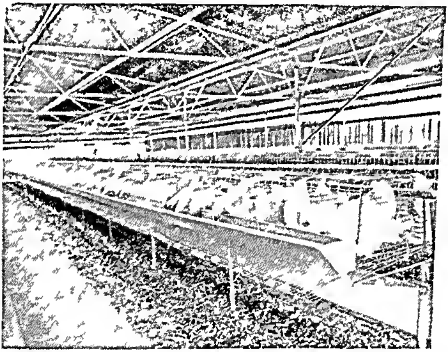
1 Building housing nearly 1450 birds *in single unit battery cages Length is* 113 and width 33 Adequate window space is allowed for light and ventilation



2 Interior of same building layers in 3 tier, single unit cages Note wide lipped feeders to save waste, and also construction of wire floor The egg rolls out, well beyond the reach of the bird Droppings trays require cleaning This type has been popular in Europe, but is not widely used in Australia



3 A well built 2000 bird cage unit of popular sawtooth roof design slatted wall sides and large silos for bulk feed delivery Slatted type sides serve for all weathers



4 Interior of the same building Birds drink from nipples but a V guttering catches drips Angle steel is shown in the construction and lights are used for increasing number of winter eggs Cages on one level have low labour needs

(*Courtesy P S H*)

pullets and first-year hens Intensity of light for cages in different positions in the shed does not have any significant effect on the laying of the birds, as established by studies at the Division of Animal Health and Production, C S I R O Poultry Research Centre, Werribee, Victoria, reported by F Skaller, T E Allen, and B L Sheldon

Careful movement around cages and absence of strange dress and noises pay dividends in not upsetting birds (This also applies in floor units) Observe points for shed construction in relation to durability and coolness (a small shade board about one foot wide is advised at 45 degrees

angle at side of single-tier cages for direct sun protection if the roof overhang is insufficient). Where single-tier cage units are used the floors underneath should be solid unless drainage is very good and conditions are mild. The labour of handling is much less with this system in a suitable shed installation. These type sheds are usually well protected at ends, but open along the sides for ventilation and drying of manure. For wet and cold winter conditions this opening needs closing up on the weather side (or both) with slats to within 12 inches of the ground as birds in cages are subject to weather variations as in all units. The slats can be hinged to the roof edge. Depreciation is less with cages of this type (except for the wire floors as common to all cages), as movable parts are not involved. Units are usually built running north and south for drying out of manure, but can operate east and west. As with various types of sheds, local conditions will be a guide as to type of battery to use. With slatted sides the single-tier open-side type can be used in medium to high-rainfall areas with moderate winds, and without protection in warm low-rainfall areas. The preferred shed design would be as shown in *Fig. 114. 3* and *4*. The multiple-tier types in closed sheds could be used in heavy-rainfall areas.

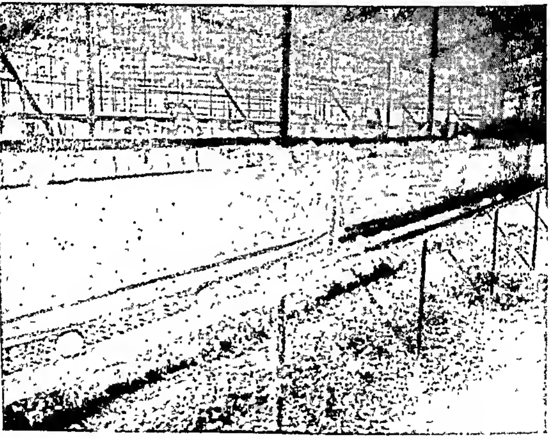


Fig. 115. Colony-type laying cages of open construction, housing birds on wire in groups allowing 1 sq. ft per bird. Laying area is in front of pen. These pose greater handling and management problems than single cages. They need protection on weather side in wintry conditions. Debeaking is necessary, and the cracked-egg problem is more acute.

—(*By courtesy of Multiplo Company.*)

Some General Points on Cages

Crossbreds from White Leghorn x Australorp cross give the best overall results with cages in Australia, although White Leghorns and heavy breeds have been used in cages overseas, and in some trials here, with good results Birds weighing 4 to 5 pounds are desirable (refer to Chapter 14 (pp 298 9) for rate of food consumption for various-sized birds) for efficiency—these birds, large enough to lay enough eggs of sufficient size, are the best converters of food Eggs of very good quality are produced when suitable rations are fed. Birds reared on range give good results in cages, they should be in pens before they have started to lay Always be careful with egg collection—picking up from wire needs more care than from a colony nest with loose material—and keep pads in the bottom of baskets or buckets or collect into fillers on an egg-collecting cart or small trolley Rats can worry birds in cages, so use usual control methods Flies can be a major problem in built-up areas—avoid overcrowding in cages, clean as required, use correct rations of high energy type, allow for ample ventilation and use approved fly control practices

Costs of Cages

This had been referred to in Chapter 4 (pp 59-60) Sheds for cage units, plus sufficient room for working operations, require a floor area of 2½ square feet and up to 3½ or more square feet per bird housed, according to system used Costs for shed and cages range from $2 up to $6 per bird For comparison take the costs of ordinary laying sheds from the examples given earlier in the chapter The lower-priced single-tier cages are worked with open-type structure Depreciation with multiple cages is much higher that with deep litter units—movable trays, wire floors and belts wear fairly quickly Cost of land in some areas will be a factor in deciding types of units to be adopted It is also necessary to allow for rearing equipment as for an all-pullet farm when using intensive rearing conditions, but allow for sufficient land if rearing on range to avoid using ground more than once a year with a heavy replacement The various proprietary lines give a basis for costs ($4 per bird extra investment may take about 1 dozen eggs to balance the extra depreciation and interest) Mass-production method of cage components compares very favourably in value with units constructed on a plant (unless the operator is skilled in constructional work) Where shed costs and space needed for multiple battery units are comparable with other units, the increase in capital cost will be the actual cost of the cages, but this will be much less with single-tier open-side cage units and total cost may be comparable to an intensive unit

Conclusions

No ruling on the respective merits of cages and floor units for all areas can be given Both give excellent production under conditions suited to their use. (California Random Test results over five tests 1957-61 show approximately 25 eggs higher hen housed lay in small pen floor groups (35 birds per pen) than for single bird cages with samples tested under two systems) Locality, rainfall, and land cost can be big factors in the decision

An operator obtaining good results with deep-litter practice, particularly with small-pen units, would not be inclined to incur expense by changing a successful system. Cages are popular for large scale mechanized operation. A person starting on a moderate scale will have to consider the factors set out as to the most efficient system to adopt, guided by his preference, capital available, land cost and local climatic conditions.

Note. Publications for reference are listed in Chapter 4 (p. 61).

Single Testing Pens

Single testing pens have been used in the past for egg laying competitions, and excellent results have been obtained with intensive units. These are relatively costly, but on quite a number of breeding farms some are used. They are very useful for single mating pens (see Fig. 116) when breeding full-sister families. Scores in the vicinity of the 300 egg mark have been obtained in tests, and birds have laid over 100 eggs in the winter test period of 122 days in Australia. The same information concerning individual birds in family lines as with battery cages can be obtained: rate of lay, size of egg, and so on.

Deep litter practice and automatic watering reduce labour and all mash can be fed. As mentioned earlier, the single unit pen is the most efficient basis for breeding practice. No breeding plant can afford to be without some single units, either floor units or laying cage units. One suitable type of pen is that formerly used for competition work in South Australia.

Details of Single Pens

The pen contains approximately 10 square feet (to halve costs an Australorp and a White Leghorn could be single tested in the same pen, identification being by egg colour). Length 5 feet 5 inches, width 1 foot $11\frac{1}{2}$ inches, each pen 5 feet 6 inches high in front and 4 feet 6 inches at back. Front is 1 foot of iron at bottom, remainder closed by a door, solid for 18 inches, balance netting, size 3 feet 6 inches by 1 foot 9 inches. This door is used for cleaning or egg collection. A 3-inch opening is left at top of pen in front through which to feed grain. Back of pen is closed up to 4 feet, usually with iron or asbestos, leaving a gap of 3 or 4 inches under roof at back. This is left open. Water is provided by guttering outside with a shade board, and birds drink through a 6 inch by 3 inch hole (*or* a line of piping with drinking nipples, one to each pen, can be used, *provided* ample ventilation is allowed, water runs slowly through in hot weather with outlet tap to keep it cool, plus a portion of the piping of plastic so that the water in the pipe can be seen). The roost is 15 inches above the floor and 1 foot from the back of the pen. A long roost serves a number of pens by passing through the divisions. Divisions are of wire-netting, a solid division being normally used every 14 or 16 pens. A feeder can be fitted in front, which can have the feed placed in from outside—whether wet mash or all mash.

The roof consists of a 7-foot sheet of galvanized corrugated iron or corrugated asbestos, giving an overhang of 15 inches in front.

The nest is an enclosed portion in front with a piece of flat iron 6 inches high set in concrete floor. When used with an earth floor (and very good

results have been obtained with this) half of a circular 4-gallon drum has been used as a nest

Note The desire of birds for some company, particularly in cool weather, is easily seen in these pens Night inspection shows the birds in adjacent pens sitting close together against the netting division This point was mentioned for the 12-bird units in this chapter

Costs for 15 Pens 30 feet by $5\frac{1}{2}$ feet

Covering material:

Roof—24 sq yds		
If cor asbestos @ 60c sq yd	$14 40	Average $14 40
If galv cor iron 15—7-ft sheets needed (approx 2 cwt) if @ $150 per ton	$14 40	
Ends—approx 7 sq yds for 2 ends—		
If flat asbestos @ 40c	$2 50	Average $3 50
If galv cor iron @ $150 per ton (3—5-fts and 3—6-fts) under $\frac{3}{4}$ cwt	$4 50	
Doors—Each door with a piece $2\frac{1}{2}$ sq ft covering up 1 ft 6 ins (4 sq yds)—		
If flat asbestos @ 40c	$1 60	Average $1 90
If cor iron @ $150 per ton	$2 20	
Back—14 sq yds—		
If flat asbestos @ 40c	$5 60	Average $7 20
If galv cor iron @ $150 per ton ($7\frac{1}{2}$—9-ft sheets) approx $1\frac{1}{4}$ cwt	$8 80	
Divisions—25 yds 5 ft x 2″ mesh netting if 18c per yd		Approx $4 40
Front—Approx $3\frac{1}{2}$ sq yds—		
If flat asbestos @ 40c	$1 40	Average $1 75
If cor iron @ $150 per ton (3—5-ft sheets cut in halves)	$2 10	
		(1)
		$33 15

		Approx super feet
Hardwood posts—		
for pen—one post every three pens front and back—		
6 posts 7 ft x 3″ x 2″ for front	21 s ft	
6 posts 6 ft x 3″ x 2″ for back	18 s ft	39
Softwood roof—		
3″ x $1\frac{1}{2}$″ rafter at ends—12 ft 3″ x $1\frac{1}{2}$″	$4\frac{1}{2}$ s ft	
and front and back top rail or purlins 60 ft 3″ x $1\frac{1}{2}$″ (none needed in between in this light structure)	$22\frac{1}{2}$ s ft	27
Front—2 lengths, one above and one below the doors, 60 ft 3″ x 1″	15 s ft	15
Back—2 rails to carry covering, 60 ft 2″ x $1\frac{1}{2}$″	15 s ft	15
Roost 30 ft 2″ x $1\frac{1}{2}$″ (Note put in place before ends put on)	$7\frac{1}{2}$ s ft	8

		Approx. super feet
Uprights—for pens in between hardwood posts, 10—5½ ft x 2″ x 1½″ for front	14 s. ft	
and 10—4½ ft x 2″ x 1½″ for back	11 s. ft	25
Division supports—the netting needs some support, but not a great deal. (The top can be left without support if desired.) A cross piece at the bottom of 3″ x 1″ and 2″ x 1″ at the top will suffice:		
14 lengths 5½ ft x 3″ x 1″	19 s. ft	
and 14 lengths 5½ ft x 2″ x 1″	13 s. ft	32
Doors—15 each requiring 12 ft x 3″ x 1″: 180 ft x 3″ x 1″ (2″ x 1″ could be used)	45 s. ft	45
Approx. super ft		206
If $10 per 100 super feet		(2) $20.60
Sundries:		(3)
Netting for doors, screws, hinges, nails, etc. .. .. .. (exclusive of waterers and feeders).		$5.00

Combined cost of (1), (2), and (3) (on this basis and without floors) = approximately $59.00 *for* 15 *pens*. Concrete floors would cost approximately $16. The total cost would be $75 for 30 birds. For single birds represents $2.50 *per* bird, and if two per pen $1.25—for materials without labour.

Conclusion

These pens share with laying cages the factor of high cost per bird. They are well suited to individual testing, and for this purpose warrant use. From a commercial housing viewpoint they would represent high capitalization of plant and heavy labour use (in view of the comparable *laying results in the small-pen units for 12 birds). For the sake of economy it*

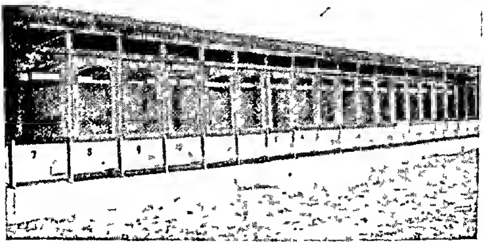


Fig. 116. Single testing pens of type in use on a stud-breeding plant. These are used for testing daughters of half- or full-sister breeding families. These pens can be an asset to the stud breeder. They are valuable for use with single-mating breeding work. A male is mated with 7 females in 7 pens and moved in turn each day of the week. Two birds can be checked in each pen if of opposite breeds (W.L. and A.O.).

CHAPTER 13

DEEP-LITTER HOUSING PRACTICE

FROM early days of the poultry industry it had always been an axiom stressed by leading authorities that sanitation was a basic necessity of poultry husbandry Daily or weekly cleaning out, and frequent disinfection of sheds, was regarded as necessary to the maintenance of health with poultry This became associated with the industry in the minds of people contemplating poultry-farming, whether as a sideline or on a commercial basis, typical expressions being "poultry are such a lot of work, always cleaning out sheds' This is definitely heavy and laborious work—and not exactly pleasant—but it was regarded as an unavoidable necessity

A change in ideas on this question of cleaning gradually became evident in various countries, possibly owing to the fact that on a number of farms regular cleaning was neglected for one reason and another, but the farms were not decimated by disease as should have been the case Observant workers noted the beneficial results with layers during the winter months of the year when manure was not removed from sheds in which the birds were allowed plenty of room Research centres concentrated on this question and over the last fifteen years a great deal of information has been made available on the story of "compost' or 'built-up" or "deep" litter, as it has been variously known The general impression given has been that deep litter is a modern practice representing one of the major advances *in labour efficiency in the poultry industry in Australia and overseas* The widespread adoption of the practice has only occurred during the last decade, but many poultrymen were carrying out this practice long before this (although generally frowned upon as dirty farmers)

Inspection has been made of a poultry unit where birds have been run on the same litter foundation for twenty-eight years! In this case the litter was established on an earth floor and periodically the rough portions of the litter would be taken for fertilizer purposes and a little straw added together with some hydrated lime The compost or deep litter in this case was 15 inches in total depth and the litter had become completely friable and dark in colour (somewhat resembling meatmeal in appearance) The laying results of the hens were very good—in excess of 200 eggs per bird Chickens had been raised from six weeks of age on the litter

This illustration is typical of work on similar lines on many other plants—but general adoption of a new practice comes slowly when it involves a complete change with a basic husbandry practice in agriculture (Years ago, conscientious farmers were proud of new clean straw in the sheds, nowadays they speak with similar pride of the accumulated litter as good deep litter!) The time saved makes the hours of work more reasonable or the handling of a larger and more efficient farm possible *and* it has made available a most valuable fertilizer for agriculture

However, certain rules have evolved in the handling of the litter for best results These are basically avoidance of overcrowding and maintaining a reasonably dry condition of the litter Some poultry-keepers have vaguely heard of deep-litter practice as something that means that it is unnecessary to clean out the sheds, and that is all there is to it As a result a grossly overcrowded shed is left uncleaned This means, under damp weather conditions, a dirty, insanitary shed that will predispose to many ailments The practices necessary to give the best results, and the reasons for the operation of deep litter, will be given

FORMATION OF BUILT-UP OR DEEP LITTER

Built up or deep litter, as the name implies, is the accumulation of the materials used for the litter combined with poultry manure until it reaches a depth of 8 inches up to 12 inches—after an original start with 6 inches depth For general work 12 inches is suggested as a maximum in order to allow the birds to work the litter sufficiently Deep litter will not form or "build up" if too many birds are kept on a given floor area—3 or 4 square feet per bird are usually required for satisfactory results

WARM MONTHS FOR STARTING LITTER

The correct starting time with deep litter is very important It must be commenced during the warm months of the year in order to allow sufficient time, before the advent of the wet weather, for the operation of the bacterial action which alters the composition of the litter *At least two months* must be allowed for build-up to start—one-month litter is only "fresh litter"—and *six months* should be allowed for litter to reach its efficiency level, which it will then maintain more or less steadily, although maximum nitrogen value in the litter may take approximately twelve months (In effect, it can be referred to as a "dry" compost action)

The latest period for starting advisable in Australia, under reasonable rainfall conditions, would be March, but in areas with rainfall 50 inches or more per year at least two months earlier should be the rule For normal procedure the late spring or early summer months are excellent For countries in northern hemisphere, for example India, the build-up could be started in March/April prior to the monsoon rains, or from September/October onwards It is not always necessary that the shed be cleaned out completely Rough portions of the litter can be raked off and the fine material left as a start for the next year Usually six or seven years are regarded as a maximum period with only periodical removal or a portion each year As a general recommendation start new litter with each year's pullets and continue with it for their laying period (For maximum fertilizer value this practice should be used)

Note Any attempt to commence deep litter in the middle of the winter months where a heavy rainfall *and* low temperatures are experienced will lead to disappointment A shed cleaned out and then fresh material, such as straw, placed in means that in a matter of days it has become damp, and shed condition is such that it probably needs cleaning out again The build-up must be well advanced before wet winter months are experienced. This build-up operates in a similar fashion to the garden compost heap

It can be started with about 6 inches in depth and let gradually build up with the manure and the occasional addition of more litter material. By means of the sterilization and breaking-down process harmful bacteria can be destroyed and beneficial vitamins are built up—this is referred to later. (If circumstances made it necessary to start in the wet period then some established deep litter should be taken as a "starter". With care, *and* frequent stirring, this may be satisfactory.)

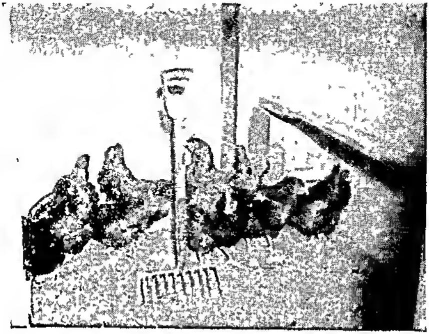


Fig. 117. 1. Excellent deep litter providing sanitary warm winter quarters in a small-pen unit when allowing 4½ sq. ft with 50-inch rainfall. The litter is approximately 8 inches in depth on an earth floor. This can be gauged from the fork, which is used for the periodical stirring of the litter. This is necessary for good results.

Fig. 117. 2. Excellent deep litter in a pen of 85 birds on a cement floor at 4 sq. ft per bird and 20-inch rainfall. Depth can be seen by comparison with the kerosene bucket. Under normal weather conditions and avoidance of overcrowding in good sheds excellent litter can be maintained.

Note When starting the litter in summer 4 to 5 inches depth of material could suffice—adding more material as required during autumn to the build up to 6 to 8 inches before the winter

TABLE 10

GUIDE TO AREA FOR DEEP LITTER OPERATION

Rainfall (inches)	*Area per bird*			
	White Leghorns		*Heavy breeds and crossbreds*	
	Small pens	*Large pens*	*Small pens*	*Large pens*
8-10	3 sq ft	2½ sq ft	3½ sq ft	3 sq ft
10 30	3½ sq ft	3 sq ft	4 sq ft	3½-4 sq ft
30 50	4 sq ft	3½-4 sq ft	4½ sq ft	4 -4½ sq ft
50 and over with fogs	5 sq ft	4½ 5 sq ft	5½ sq ft	5 sq ft

The areas listed in Table 10 are needed in pens of normal type Some operators have endeavoured to work deep litter in heavy rainfall areas allowing only 2 to 2½ square feet per bird, but the wet and sloppy material that is found over nearly the whole of the floor of the shed is not deep litter The results are below that which could otherwise be expected, as occurs with crowding either with chickens or adult stock under any system (The use of exhaust fans could alter this, but should not be needed under Australian conditions) This applies when the deep litter extends over the whole area When the roosting portion is separated by a division and cleaned out regularly or particularly where the droppings fall outside the shed as with roosts set on top of netting for this purpose, the litter can

Fig 118 Caked poultry manure this is not deep litter Deep litter is free of smell loose and friable as compared with the example shown of heavy caked manure from an overcrowded shed Deep litter cannot be obtained with birds in a roosting shed allowing about *1 sq ft* per bird

be kept dry easily (This refers to Dryden type shed See pp 231-50) In this case 1 square foot per bird for roosting area and about 2 square feet for the deep-litter scratching area should suffice in the shed The overall area of the shed can usually be reduced in this case or more birds kept in the same shed (Stirring may not be needed with this type of shed construction) Flies may be a problem with the separate roosting area No trouble should be experienced with well-managed deep litter, in well ventilated sheds without wet spots around waterers or leaky roofs

It can be seen that a pen 8 feet by 6 feet (48 square feet) can be regarded as suitable for a maximum of sixteen birds under the most favourable conditions in low rainfall down to 9 or 10 birds in a very high-rainfall area and a pen 20 feet by 20 feet (400 square feet) can be regarded as suitable for 150 birds in a very dry area and down to 75 to 80 birds in a high-rainfall area, with ordinary shed construction, but higher numbers in wet areas with Dryden type sheds

ROUTINE ATTENTION FOR DEEP LITTER

Deep litter is highly efficient as it saves the need for frequent cleaning of sheds, what was once a daily or weekly job can be an annual task only However, it is necessary that a *periodical stirring* be carried out (except possibly as above) both for spreading or levelling out the litter (birds have a tendency to face the light and scratch the litter back towards the rear of the shed) and for breaking up any tendency to caking In spite of care there is a tendency for some dampness causing a binding of the litter near the water trough, by a feeder, or under the roosts This is normally carried out by means of forking the litter over No definite time schedule is suggested as to when the stirring is required This is based on the appearance of the litter Mechanical means have been successfully used on large farms—a rotary hoe or a tractor with plough attachments has been found suitable Stirring also prevents vermin from nesting and living in the litter—this has occurred when portions are left undisturbed for long periods This is not a big labour factor in view of the heavy labour commitment of frequent cleaning out being avoided

If the litter has become fairly damp and will not maintain the desired condition, then hydrated lime (limil) may be used. One pound added for each 6 to 8 square feet will usually bring about the desired effect (provided that the number of the birds is as advised previously) Too much lime is not recommended, as it tends to interfere with the process of deep-litter decomposition Quicklime should not be used Superphosphate can be used and assists in preserving the nitrogen level of good deep litter. It can be added freely. (Ammonia is not produced when superphosphate is used) Gypsum or ground limestone is also reported as having given good results in drying out the litter and bringing about a more friable litter. Wet patches occur around waterers, these can be the cause of coccidiosis and worm infestation in the stock. See p. 452 for a suitable waterer. "Correctly managed litter considerably reduces the incidence of coccidiosis, and there is less likelihood of outbreaks than in other floor systems" (late J. P. C Smith, Livestock Officer (Poultry) Department of Agriculture, New South Wales "How to Use Built-up Litter")

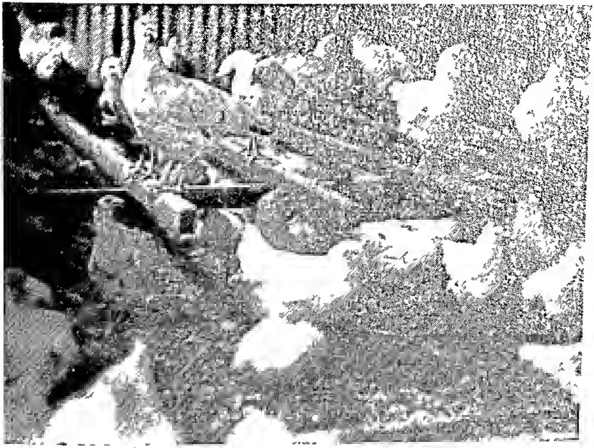


Fig. 119. Deep litter in the roosting portion of a shed, maintained in satisfactory condition when total area of shed is sufficient, and periodical stirring is used. The feeding of some grain may help, but will not replace stirring. Note the well-spaced-out roosts held in place by pins, so that they can be easily removed for inspection.

Patches that become wet should be removed and the dry litter then spread out and some extra litter material added.

Having a leaky roof is asking for trouble as, although a considerable amount of moisture can be absorbed with well-managed litter, a soaking will break down the process. An overflow of a water trough can operate in a similar fashion. Remove the wet portion and spread out the remainder as above.

VALUE OF DEEP LITTER FOR NUTRITION AND HEALTH

It will seem rather odd to a beginner to be informed that deep litter will contain some food for poultry, but research workers in America in particular have analysed litter for various nutritional factors.

Some averages have been listed by D. C. Kennard, V. D. Chamberlain, and O. G. Bentley of Ohio Agricultural Experimental Station, United States (well known research workers in deep-litter practice) as follows:—

Nitrogen	2·6%
Phosphorus	2·73%
Potash	2·0%
Niacin	4·5 mg. per pound
Riboflavin	4·5 mg. per pound
Vitamin B_{12}	118 mg. per pound

—the mineral content having been listed as phosphorus 1 2%, potassium 1 7%, magnesium 0 65%, sodium 0 63% and calcium 2 7%

Trials have shown the growth of young stock to be very satisfactory on deep litter, being much better than when stock were reared on fresh litter frequently replenished

The breaking down of waste material increases the percentage of riboflavin so that the level is very much higher in the litter after a short period than in the feed given to the birds In relation to vitamin B_{12} in one trial this was shown to increase in litter by 250 per cent over one year as compared with the original sample This is important, as vitamin B_{12} (or the animal protein factor) is needed for maximum growth with young stock or for breeding hens for good hatchability

It is necessary in all rations, and for this reason, when diets contain vegetable proteins only, growth, health, and hatchability are reduced Normal diets in Australia contain sufficient but when poultry receive such rations lacking sufficient animal protein, e g meatmeal, fishmeal, or milk powder, then if handled on good deep litter they can supplement their needs for vitamin B_{12}

The health of birds kept on deep litter properly managed is excellent Mortality rates of under 2 per cent for a full winter period in large flocks, under 10 per cent for twelve months, with down to under 5 per cent in smaller units have been obtained, particularly with crossbreds

MATERIALS FOR DEEP LITTER

Many materials give good results as the basis for built-up or deep litter Wheat straw has proved very satisfactory as a starting medium Sawdust and/or shavings have been used with a very high degree of success It is suggested, however, that only high grade sawdust be used, such as pine sawdust and fine shavings, for chickens This is preferred to hardwood sawdust, although this has been used with success for laying stock Rice hulls have been used very successfully, particularly for growing stock Meadow hay has been used when dry Leaves have been successfully used, but supply is usually limited Peanut or "ground nut" shells make very good litter material Rice (or paddy) straw is good, but must be first cut into short pieces, as it does not break up easily Horse manure has also worked very well as a litter material (Shell grit is not suitable)

Other litters which can be used where available are peat moss, cottonseed hull by products, maize or sugar cane stalks (well broken up), and seaweed Maize cobs have also been used, but do not break up well Sand has been used, but is one of the least satisfactory materials Excessive dust can be a problem, it takes much longer to build up as compared with coarse materials, which are much more efficient and vices with birds start easily with its use A percentage of moisture is necessary for efficient working of deep litter (Approx 20 per cent level is desirable)

No hard and fast rule can be stated—a mixture of, for example, straw sawdust and shavings can be used Availability of a material at the lowest cost will be the guiding factor in various districts Where straw is available for the carting only, it would be foolish to bring sawdust a long distance,

and conversely, when a mill is close by, and sawdust and shavings can be obtained for the carting only, it would be uneconomic to use other litter Likewise with some of the other products listed

It is advised that litters be of an organic origin if possible Where green feed has been fed on the deep litter any residue becomes absorbed into the litter quite efficiently With chickens excellent growth results have been noted on a high level production farm with the use of dried cow manure and horse manure as chicken litter In point of fact when the deep litter is well established it would be difficult to state what original material was used This indicates that a very wide range of materials can be used as a basis for deep litter

DEEP-LITTER MANAGEMENT FOR ALL AGES OF STOCK

CHICKENS AND GROWING STOCK

The use of built-up litter for chickens is very efficient The materials generally used are those listed on p 268, with a possible preference for chaffed straw or sawdust Some operators have used old compost litter for rearing young stock with success, but our normal feeding rations are nearly complete in their balance of essentials, so it is questionable whether risks in the repeated use of old litter for chickens need be taken on the score of nutrition The use of clean litter to start the chickens has many points in its favour Old built-up litter cannot completely cope with the elimination of coccidiosis and round worm problems Chickens raised on old hen litter have been shown to become more heavily infected with round worms and coccidia (ref Roderick L Reynolds, in an article on "Methods of Litter Management") This meant more attention needed than with chickens raised on fresh litter used from the day old stage with each lot of stock, and comparable rearing weights have been obtained If old litter is to be used, put it up into heaps for a few days between batches, and the resultant heating helps kill eggs, thus reducing the incidence of worms and coccidiosis

When chickens are three or four weeks old parts of the litter will become matted owing to their sleeping at these spots This can be controlled by stirring the litter frequently and/or removal of some of these portions

It is recommended that fresh litter be used in the case of rearing pullets, and that it be allowed to build up with the pullets However, this litter can be used again for raising cockerels in an intensive shed where it is desired to raise grillers or cockerels in between seasons (Put into heaps as mentioned above) This would follow a normal August to February rearing period for the pullets, with cockerels from March to July

Very efficient results, when feeding a balanced high protein ration, can be obtained by rearing the pullets intensively on deep litter (Refer to Chapter 11, pp 205-7)

The remarks above can refer to old built-up litter from adult poultry sheds, or with use of old chicken litter

Another problem that can arise with old built up litter from adult hen sheds in addition to coccidiosis and worm problems, is that of mites and lice When red mites and lice have been present in an adult shed their eggs

are often found in the litter and with the warmth of the brooder these hatch out and cause a considerable problem with young chickens

A rigid control programme would be needed with the adult stock some months previous to cover the possibilities of coccidiosis, worms, red mite, lice, and scaly leg, also depluming mite factors being transferred (This question of red mites, etc, in litter poses a problem when adult stock roost on litter, as well as likelihood of respiratory troubles) There is much less risk with old built up chicken litter for subsequent use, and considerable success has been reported

The general recommendation is that chickens being raised intensively on the floor should be started with fresh litter *and*, particularly with griller or broiler raising, that the pens be empty for a period between batches

Fig 120 Excellent deep litter in a large pen with over 350 birds allowing nearly 3½ sq ft per bird during the average annual rainfall of 22 inches A northern opening in the shed maintains condition of litter in winter months Ventilation requires a sufficient opening in front and at rear of shed

ADULT STOCK

For Layers Deep litter has been proved highly efficient for layers where correct space is allowed (*Refer to Table 10*)

It represents a great saving of labour Laying results have been proved highly efficient The sterilizing properties of well managed deep litter assist in maintaining health *

* One very large breeding establishment in the United States which formerly cleaned adult sheds with scrupulous attention to clearing out all material three times weekly later relied on the sterilizing properties of deep litter in pens

For Breeders The use of deep-litter practice has been proved helpful with breeding stock It enables breeding to be easily carried out intensively and helps supplement the ration

A series of experiments by Kennard, Bethke, and Chamberlain, Ohio Agricultural Experiment Station, indicated that breeders on deep litter did not require the same level of supplements in the feed as birds in pens cleaned every two weeks

Some field observations have indicated good hatchability from eggs produced on farms where birds received ordinary laying rations, but had the use of well-built-up deep litter This should not be relied upon entirely and breeding stock should be fed a suitable breeding ration

DEEP LITTER UNDER WINTER CONDITIONS

One of the great benefits is the comfortable quarters of the birds under cold conditions Cleaning out a shed every fortnight and with birds on a cement floor means they are cold, uncomfortable, and without occupation Even if fresh straw is placed in the shed, in a matter of days under wintry conditions it becomes a matted damp floor With good built-up litter the birds have a dry floor and the floor material is actually warmed for their comfort, together with the occupation of scratching and dust bathing When litter is working correctly, checking with one's hand placed in the litter will show it to be quite warm (In the early days of our industry some poultrymen raised chickens by placing an old door or wooden tray on bricks on edge and heaped litter on it and this generated heat sufficient to brood chickens placed underneath) A bag filled with deep litter becomes very hot Production from birds is governed very largely by temperature This is a factor in the difference between spring and winter production Overseas experiments have shown the beneficial effect of a uniform temperature with layers as well as humidity This means that one of the great benefits of deep litter is the warm, dry floor available for the birds This is a factor in high-level production during the winter period, as it maintains a fairly even temperature In winter it is warmer than the surrounding air Litter should be at least 6 to 8 inches deep in the winter

DEEP LITTER IN HOT WEATHER

When the laying shed can be opened up sufficiently not only several inches at the top of the back wall, but at ground-level as well, which is where the birds are (as with the Dryden type shed or shutter in the back of the shed) and when sufficient cool water is made available by having ample drinking space, mortality among stock will be lower with deep litter than with other systems It is much more efficient than with bare floors or with birds on wire floors The birds burrow into the litter in the hot weather and are cooler than by actual contact with the air only, the litter temperature is much lower than the air temperature The body of the litter maintains a fairly even temperature over the year, thus acting as an insulator for the birds both summer and winter Mortality in heat-waves has been attributed by some operators to deep litter when actually

due to the shed not having been constructed correctly to allow sufficient air circulation, and also a lack of sufficient water (this is covered elsewhere)

During summer months the moisture content of the litter may be reduced, and this would be indicated by excessive dust This is undesirable as it causes irritation to the birds—not only to the respiratory passages (with possible aggravation of complaints such as C R D chronic respiratory disease) but also to the eyes Also the litter is not working properly then—it needs some moisture It is advisable to spray the litter lightly under these conditions (It should *not be soaked* at any time)

When temperatures are at heat-wave readings spraying the litter can be carried out to relieve the birds When the conditions are such that the humidity is low (a dry heat) temperatures of 100°F will not cause undue alarm provided the sheds are well opened up, but when the temperature reaches 105°F —and no breeze is evident—conditions can become difficult in any climate Spraying would be suggested when the temperature reached the century When the humidity is high (muggy conditions) this condition may arise at 90°F As a word of warning, it is the first really hot day of the summer that is one of the most dangerous for poultry losses—usually experienced around December in Australia Three or four inches depth of litter is sufficient in the summer In areas such as India, where high humidity is associated with heavy rainfall but warm conditions, deep litter will work very well, provided that open type sheds, such as those with slatted or netted sides, are used The roof overhang should also be sufficient to prevent rain entry (See also p 216 and Appendix 3)

CONCRETE OR EARTH FLOORS OPTIONAL FOR DEEP LITTER

Deep litter can be established successfully on floors of either earth or concrete (or other impervious material) The question of capital available will frequently be a guiding factor in this respect Provided that the level of the floor is above the line of the ground outside of the shed, and the side, front, and rear walls are well in the ground so that seepage will not occur, earthen or clay floors will work very satisfactorily, even in areas with rainfall up to 50 inches When concrete floors are used they must be made correctly A thin floor only 1 inch or $1\frac{1}{2}$ inches in thickness and the wall materials not let into the ground for any considerable distance, may mean that rats can burrow and live underneath practically undisturbed, and a collapsed floor is a possibility

Earthen floors have been successfully used over long periods—many cases have been observed of up to fifteen years or more

The use of earth floors can mean a marked saving in costs in establishing poultry sheds in suitable areas For chickens it is suggested than an impervious floor be provided if possible, although here again successful results have been obtained with earth floors Litter can also be built up successfully on wooden floors These may be used where excessive slopes make them an economic proposition, or where houses are constructed with two or more storeys

DEEP LITTER FOR PRODUCTION OF CLEAN EGGS

Deep litter has a valuable feature under present-day marketing requirements Reference is made elsewhere to the need for eggs being clean for storage purposes without having to be washed Deep-litter use is one of the most efficient practices to help this Dry, well-managed litter, combined with clean nests, gives the maximum possible number of clean eggs that can be produced This is possible because the layers are kept in a clean condition, and the eggs laid are as clean as it is possible to make them (See also comment on p 232)

As nearly half the time of poultry routine is occupied with the work of collecting, cleaning and handling eggs, this valuable factor represents efficiency in reducing labour

DEEP-LITTER PRACTICE AS CONTROL FOR VICES

One of the necessary items in poultry management either with chickens or adults is to provide them with occupation Neglect of this is a predisposing cause for vices such as toe-picking, feather-eating, cannibalism, and egg-eating With deep litter there is a constant incentive for birds to scratch, which is absent with a bare or wire floor Intensively reared pullets appear to work litter better and earlier as layers, than those which have been range reared, whether fed all mash only or given some grain in the litter This occupation helps because "there is always evil for idle hands" The question of beneficial exercise is also involved

Another helpful factor is the facility for poultry to maintain themselves in a clean condition free from lice Birds will be observed dust bathing "to their hearts' content" in well-established litter—particularly if a patch is slightly dampened in warm weather On a hard, bare floor or in a cage they are dependent upon the efficiency of the person handling them to detect and control this trouble by dusting, spraying, or perch painting

DEEP OR BUILT-UP LITTER AS FERTILIZER

The final disposal of deep-litter manure does not involve the loss of a waste product It is one of the most valuable organic fertilizers available and in most cases poultrymen in localities where the value of built-up litter has become known have a ready market

Many poultrymen do not handle the litter removal from the sheds, as purchasers clean and bag as required The litter should not be left stacked outside for long periods or it will lose much of its nitrogen value (One method that has been suggested of reducing the loss of nitrogen is the spreading of 10 per cent of superphosphate over the deep litter—reference L A Wilheim, *American Poultry Journal* Consult your Department of Agriculture to decide whether your land would need superphosphate)

In field work it has been noted that many horticulturists are fully aware of the great benefit of poultry manure in orchards A basis figure suggested for average land has been that **75 to 100** birds will provide sufficient deep litter for one acre of orchard (approximately one bird per tree)

The quantity of manure obtained from poultry has been given at various figures, according to the moisture content in fresh or dry form. An average indicates that with birds of an average weight of 4½ to 5½ lb., 2½ to 3 tons of deep litter can be obtained from 100 birds in a year or 25 to 30 tons from 1000 birds in a year. (A basis for use is 2½ tons per acre for orchards, and 1 ton per acre for pastures annually.)

Note Deep litter is more valuable and much easier to handle than fresh manure. The return for fresh manure would be not as high. Drying out would be advisable before use. This would apply from cages or Dryden roosting sections. For this reason ordinary type sheds may be more popular in some areas for maximum fertilizer value, but the fresh manure can be valuable in normal garden compost heaps or pits.

ECONOMIC VALUE OF DEEP LITTER

The price that can be placed upon the deep or built-up litter is dependent largely upon its age and correct handling. Deep litter could be expected to contain 2 per cent nitrogen when six months old, and built-up litter when twelve months old could be expected to contain 3 per cent nitrogen (The nitrogen content of fresh manure is much lower—about 1 per cent.)

Phosphorus is estimated as 2 per cent and over, and potash as 2 per cent To compare deep litter with ordinary fertilizers the following information is given and a local comparable cost can be easily arrived at.

Sulphate of ammonia (20 per cent nitrogen):
Deep litter—2 per cent nitrogen, hence calculate for nitrogen value as one-tenth of sulphate of ammonia price.

Superphosphate (22 per cent phosphorus):
Deep litter—2 per cent phosphorus, hence calculate for one-eleventh superphosphate price.

Sulphate of potash (48 per cent potassium):
Deep litter—2 per cent potash, hence calculate for one-twenty-fourth of sulphate of potash price.

The price of deep or built-up litter can be worked out The following is a guide to method of calculation (not related to ruling prices).

With sulphate of ammonia at $72 per ton, deep litter (one-tenth) would have a value of .. .. $7.50 per ton

With superphosphate at $26 per ton deep litter (one-eleventh) would have a value of .. .. $2 per ton

With sulphate of potash at $72 per ton deep litter (one twenty-fourth) would have a value of .. .. $3 per ton

Note: Potash may not be necessary with most soils, hence this portion may not have a high economic value in all areas.

In this example the value would be $12.00 per ton* for all these factors without any allowance for trace elements and "build-up" for the soil.

* If the built up litter contained 3 per cent nitrogen (about one-seventh the level of sulphate of ammonia) the value could, in this example, be assessed at $3 00 per ton more = $15. (For assessing local currency values in developing areas, the Australian $ is equivalent to £ ·4 sterling, or U S $1·1.)

The type of market available will be the determining factor as to the price to be obtained for this valuable by-product of the poultry farm

Note The nitrogen, phosphorus and potash percentages given will enable the requirements for the quantity of poultry manure to be used on land to be worked out Refer to your Department of Agriculture for the requirements of various crops and soils For some types of soil, deep litter has a value far in excess of artificial fertilizers

Conclusion The nutritive factors of deep litter, the labour-saving feature, the factor of being able to run large numbers of birds in a small area, the value of the return from sales of deep litter, and prevention of occupational vices have been dealt with Deep litter can be regarded as one of the most efficient practices in operation with floor-housed birds in Australian industry *and* in developing areas today

HEN YARD LITTER SYSTEM

The use of litter in an outside yard protected by a suitable fence as a windbreak has been used by many farmers in England This has been described by G Sykes in *The Hen Yard System* Deep litter has proved a problem (without forced ventilation) and the use of a considerable depth of straw on an outside area was tried, and proved more satisfactory than birds running out in bare yards The system requires a plentiful supply of straw—extra straw is added as it becomes wet A compost action occurs, and this has been described under English conditions as satisfactory and labour-saving Claims of very clean eggs with a minimum of labour were not established under official tests The system would appear to have considerably improved results on farms where birds were running with wet yards, and it enables birds to be handled with a smaller area of land than would be required for complete range Under Australian conditions and in other areas with a milder climate the deep litter system has been proved very efficient with ordinary unlined sheds, and it would not appear particularly suited to the general sphere

SUMMARY

1 Deep litter is an efficient method of saving the labour of cleaning sheds, provided that sufficient room is allowed for the birds, and dry, weatherproof quarters are used Special care is needed around waterers

2 It is necessary for successful operation that deep litter be started at the right time of the year, which is during the warm months This will allow a sufficient time for a build-up before the difficulties of winter conditions Endeavouring to start a build-up of deep litter in the winter will give disappointing results under most conditions

3 Correct floor measurements to be allowed for successful operation of deep litter throughout the year are from $2\frac{1}{2}$ square feet per bird in large pens in mild areas to 5 square feet per bird in very wet areas with White Leghorns For heavy breeds the recommendation is from 3 square feet per bird in large pens in mild areas up to $5\frac{1}{2}$ square feet per bird in small

pens in very wet areas Refer to Table 10 for further details—a general average is 4 square feet per bird—with some reduction possible in all cases for Dryden type sheds, which successfully combine wire with floor practice Overcrowding by reducing these areas per bird will prevent the correct management of deep litter

4 Routine attention of stirring and turning over the litter is necessary, to maintain a correct litter condition When dampness occurs the use of some drying agent, such as hydrated lime (or superphosphate) is suggested

5 Deep litter is beneficial to the health of poultry and they can be successfully kept inside when correctly fed on a balanced ration

6 A wide range of materials can be used as a basis for deep litter Organic materials are preferred Straw or sawdust with shavings is popular but many materials work Use whatever is cheapest and available

7 Fresh build up of litter for each run of chickens is suggested as the best practice for the minimum of trouble with coccidiosis and round worms, and to give good rearing results with intensive rearing practice

8 The animal protein factor and riboflavin content of deep litter has been shown as helpful for good results with breeding stock

9 Deep litter provides comfortable warm winter conditions for poultry, because of the uniform temperature maintained in the deep litter This litter also serves as an insurance against the effects of hot weather, as the litter is cooler than the surrounding air (The uniform temperatures of good deep litter are an efficiency factor in helping good laying results)

10 Deep litter can be worked successfully on concrete or earth floors

11 The correct use of deep litter makes possible the production of a high percentage of clean eggs during all weather periods of the year

12 Deep litter provides occupation for birds, preventing the starting of vices, and is used by poultry as a dust bath to control body lice

13 Deep litter is one of the most valuable organic fertilizers available for orchards, gardens, or pasture It contains nitrogen, phosphorus, potash, and trace elements Superphosphate as a drying agent is particularly valuable in retaining the nitrogen value of litter for a long period Assess the economic value of litter on the basis given in the text

14 The use of deep litter is an efficiency practice for the keeping of poultry enabling the handling of a greater number of birds per operator, by virtue of the savings in labour of shed cleaning, distances to be travelled, and time spent on eggs and gives a valuable by-product fertilizer

Note Reference should be made to Appendix 3 to complete this chapter *particularly* by officers in developing areas A special feature has been made of the high economic value of deep litter as fertilizer in developing areas

CHAPTER 14

FEEDING FOR ALL AGES OF POULTRY

THE feeding of poultry is a subject upon which more has probably been written in all countries than any other aspect of poultry husbandry

This is because it is vital to efficiency that a correct usage and combination of feedstuffs be made It is the means of obtaining maximum growth of young stock, or maximum output of eggs from laying birds which their breeding background permits

The efficient handling of feeding is one of the biggest factors influencing the margin between costs and returns on the poultry unit Feed costs comprise over 60 and up to 75 per cent of the total expenses on a farm

The old adage "half the breeding goes down the throat" has merit Poultry can be regarded on the lines of a machine, inasmuch as they transform a given amount of feedstuffs into another product—eggs or meat The use of the correct proportion of the various feeds (combined with correct husbandry) determines the conversion ratio between feed and eggs (or meat) which is the basis of the whole structure of poultry-farming efficiency

APPROACH TO POULTRY FEEDING

The scope of a general textbook of this nature does not involve an extensive coverage of all the factors that make up feeds, their vitamins, minerals, acids, and so on The approach adopted is to present some rations that practice and experiment in various States of Australia have shown to be efficient for particular purposes The various rations are given in simple form on the basis of common measurements, to facilitate preparation of the rations, and a description is given of various feeding systems They will serve as an efficient basis—future findings and variations in costs will improve results with additions of synthetic products—particularly vitamins and amino acids This also applies to rations in Chapters 18, 19, 20, and 21 Sufficient information by way of graphs is also included to enable efficiency levels to be worked out in relation to feed for a given purpose

Some explanation is also given to enable calculation of the balancing of rations in order to enable substitutes to be used when normal ingredients are unprocurable, and also the effect of deficiencies Feeding equipment is also discussed

For those students desirous of further information on the background to feeding the following publications are recommended These have been used for some of the reference work of this chapter

A C T Hewitt, *Feeding Farm Animals* (Australian Agricultural and Livestock Series)

T G Hungerford, *Diseases of Poultry* (Australian Agricultural and Livestock Series)

G L McClymont and M W McDonald, *Scientific Poultry Feeding*, (New South Wales Department of Agriculture publication)

R H Morris, *Nutritional Requirements of the Domestic Fowl* (Western Australian Department of Agriculture publication)

This Chapter is divided into four parts

Part I—Various ways of feeding and economics involved pp 278-300

Part II—Suitable feeding rations for all ages of Poultry pp 300-28

Part III—Feed supplements, feed handling, and use of substitute feeds pp 328 43

Part IV—Some feed deficiencies and the feed shed and equipment pp 343 59 (See Appendix 1 for developing areas)

PART I—VARIOUS WAYS OF FEEDING

FEED FOR CHICKENS

Considerable labour was involved with some of the methods of feeding chickens in the early days of the industry Hard boiled eggs and greenfeed were used, also crushed grain or rolled oats only This was followed by the practice of feeding a number of wet mashes daily to chickens This raised chickens, but it involved too much labour for any gain compared with a suitably mixed dry all mash available to chickens at all times

This method of feeding is adopted by nearly all raisers of chickens today With all systems, the use of greenfeed either in wet or dry form is strongly recommended All mash may be replaced by pelleted mash, or crumbles or granules, as they are often termed A correct balance of ingredients is of greater importance than the actual method of feeding Conditions under which the chickens are raised will decide the type of ration to be used Simple feeds can succeed with stock on well grassed pastures, but all ingredients necessary must be incorporated, in the light of available knowledge, when chickens are reared under intensive conditions

FEED FOR GROWING STOCK

Feeding of growing stock after the initial brooding stages does not alter to any marked degree The same type of all mash ration can be fed to table poultry or pullets through the various stages, but the protein level is reduced for growing pullets from six weeks stage through to the laying period and for table poultry from eight to nine weeks of age

The protein levels required will be decided by whether the pullets are being reared under free range conditions with adequate pasture (lower protein feed) or under intensive rearing conditions (higher protein feed)

Continuation of correct feeding during this stage from approximately six weeks of age to five months (combined with the right type of quarters and handling attention) is vital to future egg production, and also the mortality and disease resistance factors The aim is to maintain a steady growth without checks—one cannot slow up or accelerate growth as desired "Keep the

pullets growing" is a good axiom Early-hatched stock under correct conditions will mature possibly a month or two months faster than late-hatched stock on the same feed ration. If pullets eat well and mature a little earlier under intensive conditions it is sound policy A restricted feed intake can be used under good range conditions if desired Alternatively restriction by higher fibre level can be practised

DIFFERENT WAYS OF FEEDING LAYERS

(*Note* Laying rations only are dealt with here Feeds for table production are given in Chapter 18)

The feeding of layers arouses much more discussion than the feeding of chickens and growing stock This is so mainly because it covers the usage of approximately 85 per cent of the feed consumed on a farm carrying 75 per cent of the stock as pullets, and approximately 80 per cent on a farm replacing all stock every year Also there can be a visible immediate result in egg output An increase in the cost of the feed for rearing the stock does not affect the budget on the farm to a great extent, as it is an increase on only 15 or 20 per cent of the total feedstuff used (This also lends weight to the recommendation not to stint young stock, as it is "penny wise and pound foolish")

Economy, provided it is not below the efficiency level (refer to the ready reckoners in this chapter for the required levels of feed), is very necessary with feed for layers, as it has such a marked impact on costs A definite level of feed for a given rate of lay and size of bird, has been established, by official tests and practical farmer results in many countries of the world Hence do not stint feed, but also do not use more than necessary. *The energy level of the feed and its correct balance for protein/energy ratio will be dominant factors in this* The extra feed the hens eat or waste which is not used efficiently is money lost This should be available as part of the labour and management return from the flock handled Adopt the particular feed that suits the system of handling layers, and the availability and cost of different feed ingredients For example crushed grain feeds (high energy) would be used to save costs when bran and pollard (low energy) was close to the grains in price per pound

Wet-mash Feeding System for Layers

The wet-mash system has been used successfully in all States of the Commonwealth The use of bran and pollard for poultry mash feeding has been mainly responsible for this Dry mashes are not suitable with bran and pollard only, being too bulky and fine Bran and pollard should be used as a wet mash Most of the outstanding official single test egg-laying competition results were established with its use For example, Hawkesbury and Parafield competitions The system has largely fallen into disuse, because of the heavy labour factor.

It is palatable for the birds when mixed correctly, which is in a damp crumbly condition, not a soggy mass A good portion or the whole of the greenfeed given to the birds can be easily incorporated in the daily wet

mash In cases where a limited supply of greenfeed has been available, this has been included and the balance of vitamin A requirements covered by the use of an oil-emulsion supplement in the mash This has worked well, both for greenfeed short in supply or poor in quality The skilful feeder—which really means one careful in preparing the mash and adjusting the level of mash according to the rate of laying—controls the level of feed intake to the amounts shown on the ready reckoner included in this chapter The inclusion of any supplement desired in the ration for treatment of stock is easily carried out Ingredients of a moist or liquid nature can be easily incorporated This can sometimes mean quite a saving, for example, skim milk used for mixing the mash saves on meatmeal, or whale solubles, meat scraps, rabbits, can be incorporated easily as protein

The presence of sick or off colour birds can be seen easily They show up by standing around at feeding time instead of coming for the mash like healthy birds Appetites can usually be kept keen with wet-mash practice (The correct method of mixing is covered later in the chapter)

The necessity of daily feeding is a disadvantage because of the continual labour involved However, there is no need to feed at a very early hour—poultry can become quite accustomed to feeding at for example 8 30 a m (In hot weather it is advisable to feed as early as possible, as birds do not eat readily when the day has become hot) No greenfeed other than that included in the mash need be given for the day The grain feed can be given in the afternoon, split into two feeds if desired to provide occupation over the day (This can be arranged to coincide with egg collection) On very large plants the employment of labour for wet-mash feeding may be justified by the controlled level of feeding, and also the saving of waste The laying results are as high as with any other system

Some prepared mashes purchased ready mixed can be fed as wet mash The quantity required is as set out in the sample rations shown When the cost of bran and pollard is considerably lower than crushed wheat (under two-thirds in price per pound) wet-mash feeding can show reduction in cost of ingredients for feeding layers This saving would be assessed against labour Although probably the earliest method of feeding layers since commercial poultry-farming assumed reasonable proportions in Australia, it can still be applied under certain conditions, when mill offals are low in price, in view of reasons cited above

Note Feeding a wet mash on some days and dry or grain on others is the best possible way to upset production completely Whatever practice is adopted must be carried out regularly—this applies to all systems Rapid changes from one feeding system to another or even the alteration of the kind of grain fed,* without making gradual change, will reduce production at most periods of the year If this occurs with the approach of the off season it can mean an early moult and a long period of low production

* *Do not try to economize by feeding cheap, poor-quality grains, if some* grain of this nature becomes available Efficient laying results are bound up with good feed quality The use of poor quality ingredients reduces lay, apart from the effect of any sudden change in diet The use of alternate grains when available at cheap rates on an energy basis is sound practice

Dry-mash Feeding, Including use of All Mash

DRY MASH PLUS GRAIN

Dry-mash feeding has been used by various operators in three ways

1. Feeding a measured quantity of dry mash each day (but this does not represent any great saving of labour as compared with wet mash)

2. Provision of dry mash in hoppers open for a few hours of the day

3 Free choice of dry all mash available at all times to the birds This gives the greatest efficiency in relation to saving labour and is the system recommended The hoppers should be well made to save waste of feed (A possible source of wastage with dry-mash hoppers open at all times can be that due to vermin Hoppers should be built with this in mind, plus the use of eradication measures)

Consumption of feed can be greater than the wet mash, as birds may eat more than is required for their maintenance and the production of eggs This will be determined however by the correct balance of feed for energy and protein The graphs covering feed required per dozen eggs shown in the chapter illustrate the economies of this question

Dry-mash feeding has a marked appeal because it saves the need for regular morning or daily attention The time for feeding greenfeed is still involved, unless lucerne meal plus vitamin A powder or emulsion is included in the mash This is giving efficient results today when good-quality lucerne meal is used. Greenfeed can be given in addition to this and helps save on feed costs, although involving extra labour Grain can be fed as a separate feed. This may help promote occupation and exercise with deep-litter sheds and help maintain litter condition

Provision of grain also in hoppers as free choice can mean upsetting the balance of the ration, through birds eating too much grain in proportion to mash (unless controlled by opening the grain hoppers for only a set period) This tendency to over-consumption of grain has been controlled by some by mixing the grain with the mash in the desired proportion This would be equal parts mash and grain by weight with a 20 per cent protein mash, or 2 parts mash 1 part grain by weight with a 17 per cent protein mash This has also been extended to mixing whole grain with concentrate mixture

Texture of the dry mash is all-important A high percentage of coarse ingredients is necessary As mentioned previously bran and pollard will not suffice—a fairly high proportion of crushed grain must be included It is desirable that 50 per cent crushed grain by weight be the minimum incorporated in all mash (The rations shown on the graph for meatmeal levels to balance varying levels of grain with bran and pollard are suitable as dry mash from the 50-50 mark up to 100 per cent grain) Suitable dry mashes are also prepared by proprietary firms

Efficiency of All-mash Feeding

This system is the use of a coarse mash without any separate grain being given—it is a complete feed in itself The name implies that it combines the mash and grain It is provided in hoppers or feeders for the birds to have

access as desired during the day The only additional feed is greenfeed, but with lucerne meal and oil emulsion or powder-form vitamin A included, it can be given as a complete ration with very efficient results This type of feeding is used by the majority of operators using the battery-laying system and deep-litter intensive systems It is used with successful results in the Random Sample Tests both in Australia and overseas It makes once a week feeding quite practicable

All-mash feeding is the most labour-saving system possible and is being used very extensively indeed under present-day conditions It is also a very satisfactory type of feeding for sideline units on grain farms where crushing facilities are available * Grain below marketing grade can be retained on the farm for this purpose (Birds on all mash are quieter than birds given feeds at various times daily. There is no "anxiety stress" involved as with birds awaiting feeding times This is also an advantage for weather extremes, and lower bird losses under heat wave conditions)

Reference to the sample rations given shows that the all-mash rations range from nearly three quarters crushed grain to all crushed grain This is vital to its success, as it not only needs to be coarse in texture for dry feeding, but to be efficient as a high-energy ration it needs a high proportion of grain (When mill offal is sufficiently low in price, include up to one-third of the total weight)

The decision as to use of this system will be guided by price and availability of crushed grains as compared with bran and pollard (a basis for calculation is given later), together with the labour and time available When using deep litter practice the all-mash system means that the birds may not work the litter as often as when searching for grain, hence it may be necessary to stir the litter occasionally by hand or mechanical methods This is influenced greatly by the ventilation given in the shed Less skill and labour is needed to feed this ration than the wet-mash and grain system It is recommended as recent and up-to-date practice for sideline operators, commercial units and laying-cage systems to give the best possible returns for the minimum use of feed, time and labour

Cafeteria or Free-choice Feeding System

Under this system the hens are allowed the choice of a balanced dry mash, meatmeal (plus other high protein concentrates) and grain, each in separate hoppers This system can be successful, but there is often a tendency for birds to eat too much grain or meatmeal Birds may be attracted by the appearance of various ingredients, and do not necessarily arrive at a reasonable balance when suitable feeds are available When meatmeal is available free choice, birds may eat more than is necessary to balance the ration There is also the necessity to service three hoppers instead of one Results can be satisfactory, but rate of consumption of the various feedstuffs should be closely watched

* Crush grains for mixing the all mash once a week or fortnight This ensures fresh ingredients, and prevents vitamin E loss which can occur when crushed grains are held for long periods The grains should only be crushed coarsely with only enough fine material to carry the vitamins etc

Free Choice of Grain and Meatmeal

This system has been used by some commercial men in the past but generally by operators with sideline units on farms where grain is grown Costs of grain are usually valued by these operators at net price on the farm

The practice on many sideline farm poultry units has been the feeding of grain only, which results in very low production except during the spring months, when birds on range may obtain sufficient natural protein to balance the feed (insects and grubs) The overall production is very low because production rapidly declines in summer and only sideline units making a balanced feed available produce efficiently during the difficult months ('Any stock fed anyhow" can lay in the spring but will not do so once this period is passed) Grain can be made available in hoppers or fed out daily to the birds Meatmeal (or meatmeal together with the other protein rich foods mentioned under Substitutes) is supplied in a hopper or fed out in troughs In effect it means that grain and meatmeal (or the concentrate mixture) can be given in separate hoppers and act as a reasonably efficient laying ration The difficulty is that birds do not balance efficiently when this 10 to 1 basis is called for, and alternately too much grain or too much meatmeal is consumed The meatmeal plus supplements can be placed in a hopper, and the necessary grain fed to the birds each day Greenfeed should be given in addition, but if not practicable to do this, provide lucerne chaff or lucerne meal plus vitamin A supplement (An extension of this is to make a concentrate mixture with the meatmeal, lucerne meal, also vitamins and minerals This can then be fed separately, and works well Alternately mix it with whole grains (For proportions and details see *Fig 12 and* Appendix 1)

Special Points to Watch

1 Feather eating due possibly to the monotonous diet can be a problem, hence it is desirable that some oats be included to help control or prevent this trouble (Alternatively debeak the birds) Other grains can also be used in the mixture according to price levels

2 Ample greenfeed should be given with this system, otherwise lucerne chaff or lucerne meal plus vitamin A supplement must be included

For other details refer to the mixtures given (pp 314 6) in this Chapter Where rabbits (or other meats) may be available on general farms then 3½ to 5 lb of this meat daily per 100 birds would supply the necessary protein in place of the meatmeal and would give excellent results

Use of Skim Milk and Grain Feeding

Skim milk available on some farms has valuable properties for growth and egg production Many sideline farms have obtained very satisfactory production by making skim milk only freely available to the layers and feeding grain plus ample greenfeed It is important that when the milk is given as a drink it be always in clean or sour condition but not both alternately, or scouring and digestive upsets can occur When used in conjunction with deep litter it has given good results under farm conditions

It can be used with the meatmeal and grain system The quantity of meatmeal can be reduced considerably Results will be improved by the provision of this excellent ingredient as a drink and the meatmeal reduction would be brought about by the birds eating less It can be used at all times if available on a farm It involves considerable labour, but if obtainable at very little cost this can be an economic proposition

Soaked-grain Feeding

In the 1930s the system of soaked grain feeding became widely used, but it did not remain popular Tests carried out in various States indicated that laying results were not as good as with other feeding systems The labour factor is much heavier than with wet mash, as the grain is soaked from 12 to 24 hours before being fed with other ingredients added Some have soaked the grain longer than this There is no particular gain with this system on farms as compared with the other systems of using grain, and the extra labour factor is against its use

Pellets

Pellets are prepared by proprietary firms and give satisfactory laying results when correctly balanced for protein and energy There is no particular virtue in pellets as compared with prepared high energy mash The basic mixture is the same The comparative cost of each can be the deciding factor The preparation of both is the same up to nearly the final stage as mash For pellets the mash is then taken and compressed through the machine into small pellets The advantage that could be claimed for pellets is that there is less likelihood of waste due to wind and birds picking out parts of the feed, also a more even dispersal of the various ingredients could be possible They can be fed in hoppers or fed out on a measured basis daily Some also feed them in the litter Pellet feeding has proved popular with a number of commercial producers and sideline operators The use of pellets must be on the basis of their protein (and energy) content A sufficiently high vitamin level (A, D_3 and so on) is usually included to overcome losses due to pelleting Pelleting of feeds high in fibre and low in energy improves the energy level

If the pellets are stated to contain 20 per cent protein, then feed with an equal weight of grain, if 17 per cent protein 2 parts pellets to 1 part grain by weight, if 15 per cent then feed without the addition of grain

Greenfeed should be given in addition, the quantity to be decided by the level of vitamin A stated to be incorporated in the pellets unless they contain a sufficient level of lucerne meal Greenfeed will save on pellets consumed and also tend to counteract a tendency to feather-picking and other troubles, which may occur (as with most monotonous diets) Feather-picking control is covered in Chapter 22 (Pellets are extensively used for ducks, turkeys and geese) (See also pp 285-6—pellets for chickens)

WHICH SYSTEM TO RECOMMEND?

Many official tests, and the results on farms where most of the various systems have been used successfully, indicate that many systems work well, provided that ingredients are correctly balanced No one can say that

there is only one system, as too many examples can be quoted of other systems that have worked well Various systems have been described and the points for and against given The basis of assessment should be on the lines of economy of feed *and* labour for a given result This is to be considered in conjunction with the availability of supplies of various ingredients The sideline producer with home-grown grain will prefer concentrate mixture purchase, while the commercial producer prefers a complete all mash ration The above, and the balance of the chapter, should enable a decision to be made as to the best system for a particular poultry unit Also remember when you have a good system, don't alter until another has been proved better The recommended system, popular with the producers here and overseas, is that of feeding high-energy all mash for the lowest feed costs and consumption, and minimum of labour needed, followed by that of concentrate use (See Appendix 1)

READY MIXED OR PREPARED RATIONS

The advance of specialization in the poultry industry in Australia mentioned in other chapters also applies to poultry feeding It is becoming more efficient for each section to specialize—and stock and feed supply for poultry keepers enters this category

Many poultry-farmers in various States are faced with considerable difficulty during some periods in obtaining the required ingredients

This applies with the supply of various grains, mill offals, and protein supplements This has been a factor with many farmers in using prepared feeds to avoid loss of time in endeavouring to obtain various feedstuffs Fear of loss of production due to alterations in the ration fed to the birds brought about by sudden and unforeseen shortages is another cause For these reasons, also saving of labour cost of mixing and crushing equipment, safeguard against sickness, etc , a number of efficient commercial poultrymen have adopted the practice of using prepared rations when these are available at reasonable price levels By virtue of the time saved they can handle more birds to obtain the desired target needed for a unit—but from the minimum number of stock possible—or devote more time to improving the efficiency of other husbandry operations on the unit

In many cases, and particularly with sideline units, the use of reliable prepared rations would be the most efficient procedure to adopt The cost might appear more on a pound for pound basis, but the better results from a ration of constant protein and energy value could more than compensate by better growth or egg-production figures obtained plus allowance for saving on labour and capital equipment

PREPARED OR READY-MIXED FEEDS AND POINTS TO CHECK

Many proprietary firms have specialized in the production of prepared feeds for poultry either as mixed mashes or as pellets The installation of efficient machinery for mixing large quantities of mash ensures even distribution of ingredients, and with such specialized machinery the even

distribution of vitamins and trace elements is possible Many of the firms have based their products on proven rations in collaboration with their State Department of Agriculture Laboratory facilities also help, e g testing grains for protein to cover the wide variations in levels which occur with grain from different areas in a State to maintain a constant level of protein in feeds Popularity of various mashes can be an indication of their value Proprietary mixed all mashes make possible the purchase of a complete feed as one line The ability to buy large quantities of feed usually means cheaper buying and that reliable established firms can maintain a product that is reasonable in price and does not vary to any marked extent in the balance of ingredients Some ready-mixed feeds compare in price with the cost of ingredients for mixing on the farm when buying in small quantities, without any allowance for labour involved on the part of the farmer The labelling of bags with the description of the mash (or pellets), for example chicken mash or layers' all mash, together with information on the protein and energy level, ingredient basis and vitamin levels for A, B_2 and D_3, etc would be very helpful when purchasing, and should be checked if possible

Where minimum levels of the basis of mashes are shown, periodical analyses are taken to check that the mashes do not fall under these stated levels This work is carried out in Australia by officers of the various State Governments

CORRECT USE OF PREPARED OR READY-MIXED FEEDS

From Day-old to Six Weeks

For young pullets from their first feed up to six weeks of age the all mash usually known as battery mash is required This should contain a fairly high protein level at least 17 to 18 per cent and a sufficient level of vitaminized oil or powder containing vitamins A and D_3 plus riboflavin Vitamin B_2 It is given as the complete ration This is also sold in the form of granules or crumbles, which are made available in the same way

It is quite good practice to provide some chaffed greenfeed in addition from four or five days old This promotes interest, particularly with a battery brooder, and reduces the tendency to cannibalism and feather-picking sometimes occurring on monotonous feeds (more so with pelleted feeds) and can be a safeguard against minor deficiencies It is optional if good quality lucerne meal is included in the ration

From Six Weeks Old to Laying Period

The prepared feed to be used during this stage is usually known as growing mash and is available either as all mash or in pellet form This can also be fed in conjunction with grain (according to protein level) and greenfeed, but is becoming popular as a complete all mash without additions (when lucerne meal is included)

The ration to be used can be varied, according to the rearing conditions available—whether on ample range with good pasture or rearing inside intensively will be the guide as to the mash to purchase A growing feed containing 16 per cent protein together with 25 per cent grain (fed separately or added in crushed form) gives good results with range reargin under

good pasture conditions If rearing inside under intensive conditions this would be used without extra grain This can be the same type of feed as used for the first six weeks (battery mash) with extra crushed grain added It is vital to check on the question of sufficient vitamin A and D_3 (plus other vitamins as needed) being included in the ration when the intensive rearing method is used Sufficient sunshine is not available inside a shed during the rearing period, also vitamin A levels in greenfeed are lower in the early part of the season It is a recommendation that a small quantity of A and D_3 supplement should be included at all times in all feeds for poultry of all ages

PURCHASING PREPARED FEED FOR LAYING STOCK ON PROTEIN VALUE

Many operators purchase laying mash or laying pellets without thought being given to the protein aspect of the ration and the quantity of grain to be fed with it A lack of knowledge in this respect can be costly, as it reduces efficiency with the feeding of the layers (This is one of the reasons for all-mash use being a safe practice)

Prepared mashes are mixed and sold at different levels of protein This means that the grain level must be varied accordingly to give an overall level of 15 per cent If the mash is rated as 20 per cent protein then it is fed with an equal quantity of grains *by weight* to give the 15 per cent level If rated at 17 per cent protein then 2 parts of this mash to 1 part of grain by weight No complications arise with 15 per cent protein all mash, because no grain is needed

The particular aspect it is desired to stress at this point is to assess cost of feed on the basis of protein value (energy is dealt with later)

The cost of a mash is governed largely by the percentage of protein rich foods added to lift the level of the mill offals or crushed grains composing the main bulk The cost of the overall ration is decided by the amount of grain to be fed with it (and its efficiency by its energy/protein ratio)

Example No 1 A mash of 20 per cent protein selling at $60 per ton and with grains (10 per cent protein) at $40 per ton The protein levels require the use of half and half by weight to give 15 per cent protein The average price per ton would be

1 ton mash at $60
+1 *ton grain at* $40
2 tons feed cost $100
therefore 1 ton costs $50

Example No 2 A mash of 17 per cent protein selling at $58 per ton (and presuming equivalent energy level) and with grains (10 per cent protein) at $40 per ton This would have to be calculated differently as it is necessary to feed 2 parts of this mash to 1 part of grain to obtain the required 15 per cent protein level The average price would be

2 tons mash at $58 = $116
1 *ton grain at* $40 = $40
3 tons feed cost $156
therefore 1 ton costs $52

It will be seen that when prices are on this basis it would be more economical to pay $2 per ton more for the higher-protein mash If grain was dear in proportion to mash then it *could* pay to buy the lower-protein mash

Example No 3 If an all mash of 15 per cent protein level was available at a cost of $50 per ton (and grains cost $40 per ton) then it would be just as economical to purchase this In this case grain would not be needed

These examples illustrate the advisability of purchase on protein basis (The question of checking for energy as well as protein is covered later in this chapter)

METHODS OF ASSESSING FEED COSTS

To work out the feeding cost of a laying bird per year for any particular price of feed as obtained above, the graph shown below has been prepared This covers cost of complete feed ration Assessment can be quickly made for any price of feed per ton or per pound in terms of 90 lb of feed consumption per bird per year

ALTERNATIVE USE OF COSTING GRAPH

If desired the same graph can be used for cost of rearing pullets or cockerels by adjusting in proportion for the quantity of feed consumed e g 22½ lb of feed to raise a pullet would be one quarter of the figure obtained for a given feed price It is also possible to work out daily costs of feeding for numbers of birds if desired, as the figure of 90 lb of feed would apply for 360 birds at 4 oz daily or for 240 birds at 6 oz daily

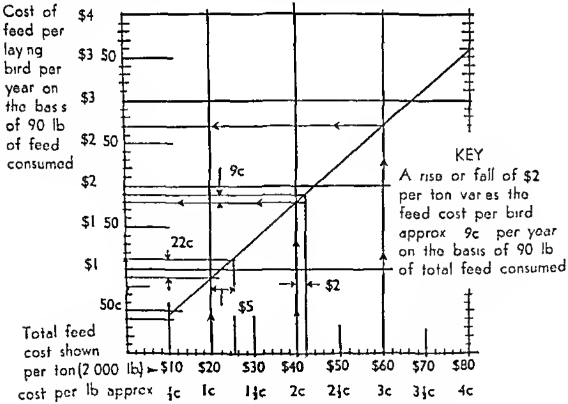


Fig 121 **Costing the complete feed ration**
Read by moving up to line and then across

PREPARED MASH COSTS VERSUS MASH MIXED ON FARM

Enquiry might be made at this stage as to a basis for assessing the cost of feed mixed on the farm, following discussion on the purchase of prepared mashes Mixing the feed on the farm has been referred to in relation to availability of supplies, also the skill of the person mixing the feed, and the labour involved Suitable rations are described later in the chapter A simple basis is given at this point to give a lead on the cost of mixing mash on the farm, given cost of various ingredients

READY RECKONER FOR CALCULATING *APPROXIMATE* COST OF HOME-MIXED MASH

(*a*) When mixing a 20 per cent protein mash with bran and pollard taking five-sixths of the price per ton of bran and pollard and one-sixth of the cost of the average price of protein supplements used (45 to 50 per cent level protein) per ton added together gives the cost per ton of mixed feed, for example bran and pollard $42 per ton (five-sixths = $35) and meatmeal $72 per ton (one-sixth = $12), making cost per ton of feed $47 (with approximately 16 per cent meatmeal included to give 20 per cent protein)

(*b*) When mixing a 20 per cent protein mash with crushed grains take three-quarters the price per ton of crushed grain and add one-quarter the average price of protein supplements used, which together gives the cost per ton of mixed feed, for example crushed grain $48 per ton (three-quarters = $36) and meatmeal $72 per ton (one-quarter = $18), making cost per ton of feed $54 (with approximately 23 per cent meatmeal included to give 20 per cent protein)

Note To obtain the cost of the complete ration of 15 per cent protein (when using equal parts of 20 per cent protein mash and 10 per cent protein grain) add the cost of 1 ton of grain to each example With grain at $48 per ton the following will apply

(*a*) Mash $47 plus grain $48 = $95 for 2 tons or $47 50 per ton.

(*b*) Mash $54 plus grain $48 = $102 for 2 tons or $51 per ton

This combination would also represent the price of 15 per cent protein all mash (The ration for (*b*) would be high energy all mash)

Note To calculate feed consumption refer to the basis given later for calculation of energy levels This will show that the feeding cost would be much lower with (*b*) because of approximately 15 per cent less feed consumption than with (*a*) because of the higher energy level of (*b*) This would mean that where 1 ton of (*a*) costing $47 50 would be eaten, only five-sixths of a ton of (*b*) would be used costing $42 50—a saving of $5 when these prices applied

GUIDE TO CONSUMPTION OF FEED (PER SHORT TON OF 2000 LB)

One ton of total feed will, according to energy level, from, for example, 750 to 900 units per lb last 1000 birds from 7 to 8½ days

This is based on 4 oz *average* per bird daily This can more than supply the *average* 200 to 225 units of productive energy needed for an average size layer daily, when high energy feed containing 900 units per lb is used More feed would be used with lower energy feeds As a ready reckoner basis 1 ton per 1000 layers weekly could be taken as a safe figure on which to base feed needed

PITFALLS IN DETERMINING FEEDING MIXTURE, CALCULATION OF PROTEIN IN RATION

A basis is given in this section for a method of finding the total protein in a feeding ration for growing stock or for laying birds This makes it possible to adjust the mash if the normal ingredients are unavailable for any reason It must, however, be kept in mind that the protein level of the ration is not all that matters, the type of ingredients which form the mash can make or mar the results

A few examples that indicate mistakes often made are as follows·

1 A chicken mash of correct protein level but without vitamin D_3 added and the chickens develop rickets although the protein level is sufficient

2 Adequate protein level in a chicken mash but without a small percentage of animal protein (e g meatmeal or fishmeal) means poor growth if only vegetable proteins such as coconut or peanut (ground nut) meal used

3 Use of all crushed grain in a chicken mash adequately balanced for protein but lacking manganese sulphate This addition is necessary when over 50 per cent of bran and pollard is replaced by crushed grain resulting in chickens developing perosis (leg weakness) Grain type decides level needed

4 A ration correctly balanced for protein for raising chickens but lacking sufficient riboflavin owing to omission of milk powder (or other products high in riboflavin), thus causing curled toe paralysis

5 A laying mash correctly balanced for protein but containing a very high percentage of bran This would give a very low energy value with consequent reduced laying results and high feed consumption (also eating fatigue and loose droppings condition)

6 A crushed grain laying mash, used for breeding hens, correctly balanced for protein, but the eggs giving very poor hatchability and weak chickens owing to the lack of riboflavin and manganese supplements

7 A mash correctly balanced for protein but not for energy/protein ratio (e g 60 to 1 for layers)

8 A chicken mash using 40 per cent meatmeal thus giving poor growth

9 Rickets caused by feeding shellgrit with a high-energy chicken mash, due to excessive calcium level

These are a few examples (many more could be cited) which illustrate that a mash must be correctly balanced in many more respects than protein only The thought that if some item is left out of the mash it will not matter very much can be the cause of lowered returns, in growth or eggs, increased mortality and lowered disease-resistance

For these reasons it is stressed that the rations given as examples should be used without omissions They are proven as efficient for their particular purpose as the result of research, experiment, and practical application under field conditions Future work may indicate further economic additions (see also p 494)

HOW TO FIND LEVEL OF PROTEIN IN FEED

CHECKING LAYING RATION FOR PROTEIN—IDEAL LEVEL—FOR OVERALL RATION IS 15 PER CENT PROTEIN

Using a laying ration as an example will serve as an illustration of how to balance the feed Some explanation will also be given covering the inclusion of substitutes

A very simple basic laying ration is as follows

	Mash		*Grain*
	60 lb pollard		
	25 lb bran		
	14½ lb meatmeal		100 lb
	1 lb salt		
approx	100 lb mash	AND	100 lb grain

(This would be a sufficient average quantity of feed for 750 to 800 layers daily)

The approach to actual working out of this feed is relatively easy Take each of the ingredients and then multiply the number of pounds of this ingredient by the known protein percentage Analysis has shown the levels *average samples* would contain, and then divide the complete total by 100, and the answer is the protein content of the ration Proceeding we have—

60 lb	pollard x 15% protein content in pollard	900
25 lb	bran x 15% protein content in bran	375
14½ lb	meatmeal x 50% protein content in meatmeal	725
1 lb	salt (does not contain protein—necessary for sodium and chlorine level in feed)	
100 lb		2000

Divide 2000 by 100, and we have the answer as 20, which gives us the protein content of the mash as 20 per cent (The same answer can be obtained by dividing each item in turn by 100 instead of the final figure—that is, 9 plus 3 75 plus 7 25 = 20)

Note Some confusion may exist in the mind of the reader as to how to work out the protein content if it is not a total of 100 lb This does not upset the ease of calculation at all—divide the total weight of feed into the grand total in the same way whether for 200, 400, or 500 lb of feed and the answer will be the protein content Now we deal with the grain in the same manner

100 lb of grain x 10% average protein* contained in grain (may be up to 11%)	1000
100 lb	1000

Divide 1000 by 100 lb and we have the answer as 10 for the protein content of the grain

We now have 20 per cent protein for the mash and 10 per cent protein for the grain By adding these together and dividing by 2, we have an average content of 15 per cent, which is the required level of protein for a laying ration

Adjustments can be made to work out different rations For example, when bran and pollard are short in supply or high in price, and crushed grain is to be used in their place to make up a high energy ration The average protein of crushed grain is rated at approximately 11 per cent It is readily seen that an increased amount of meatmeal will be necessary to maintain the level of protein The mash would then be altered as follows

76 lb crushed grain x 11% protein in average sample	836
†23 lb meatmeal x 50% protein in average sample	1150
‡ 1 lb salt (no protein value) and ½ oz manganese sulphate	
100 lb	1986

which gives approximately 20 per cent protein (19 86 per cent) for first example and when combined with the grain in the same way would give an average of 15 per cent level in the total ration of 200 lb

Note It could be asked why bran and pollard alone could not be used as these contain 15 per cent protein, without meatmeal and grain This question is cited to illustrate again the point stressed that protein level is not the only factor The ingredients of a ration must form a correct balance of foods containing protein and carbohydrates, sufficient "high-energy ingredients", animal protein, and the various vitamins and minerals required

* Samples vary widely according to growing conditions in various districts, seed varieties used, etc They *may* vary from 7 per cent to 14 per cent

† Should the meatmeal be 60 per cent protein, then 19 lb meatmeal with 80 lb of crushed grain would balance the mash If only 40 per cent protein meatmeal then 32 lb of meatmeal with 67 lb of crushed grain would be needed to balance the mash If a portion of the meatmeat was replaced with butter or skim milk powder (35 per cent protein), then calculate by averaging with the meatmeal, and then calculating as for meatmeal in the above example

It may happen that some vegetable protein such as linseed meal (30 per cent protein) or peanut meal (50 per cent protein) is available at a competitive price with meatmeal on protein cost basis In the case of peanut meal (also known as ground nut meal) it could replace a percentage of the meatmeal pound for pound without altering the level With milk powder or linseed meal it would mean that if 5 lb were included then the meatmeal could be reduced by 3 lb to 20 lb and the total weight of mash and protein level would be approximately correct

‡ In an all grain mash it is necessary to add ½ oz. to 1 oz. of pure manganese sulphate to the 1 lb of salt (according to grain used) to maintain a sufficient manganese level

CALCULATION OF ENERGY CONTENT OF RATION

Protein level has been covered, but the energy content of feeds is also very important The higher the productive energy level (which equals net energy) in terms of calories per pound the less pounds of feed needed for meat or egg production Grains have the highest content (apart from fat, which is rated at 2900—can only be used when cheap enough for energy compared with grains) High-energy grain rations mean up to two pounds less of feed can be used to produce either one pound of poultry meat or one dozen eggs than with low-energy feeds Similar savings occur with rearing pullets

This can be very important in reducing costs when mill offals are close in price to grain In this case a ration of grains costing more per pound will be cheaper in the long run because of less feed used For example wheat at 1020 units per pound is a better buy than bran at 480 units unless bran per pound is under half the price per pound of wheat One ready reckoner basis for buying based on energy levels is bran and pollard are of equivalent value when their average price per ton is just 20 times that of wheat per bushel For example—bran and pollard at $32 per ton has an equivalent value to wheat at $1 60 per bushel

Some popular ingredients and the productive energy* contents given for average samples are (with food unit percentages shown in brackets) maize 1150 (76), milo 1110 (75), liver meal 1100 (80), wheat 1020 (75) fishmeal 900 (60), peas 820 (67), barley 810 (65), rice (paddy) 770 (62), oats 760 (60), meatmeal (60 per cent protein) 750 (80), ground nut meal 730 (75), meatmeal (50 per cent protein) 720 (66), pollard 720 (60), rice bran 700 (50), molasses 700 (50), soya bean meal 565 (68), skim milk or buttermilk powder 520 (76), dried whey 500 (83), wheat bran 480 (40), lucerne meal 300 (25) (These energy levels apply for poultry, and do not compare evenly with starch equivalent or food unit basis as applicable to ruminant animals)

EXAMPLE 1 (Units of productive energy)

Mash (20 per cent protein)		*Grain* (10 per cent protein)	
60 lb pollard x 720 units per lb	43,200	100 lb x 1020	102 000
25 lb bran x 480 units per lb	12,000	(This applies with wheat—adjust for other grains or proportions of same from list For example, half wheat and half oats would be 890 per lb)	
14½ lb (50% protein) meatmeal x 720 units per lb (— salt)	10,440	100 lb	102 000
100 lb	65,640		
hence units per lb	656 4	hence units per lb	1 020

* On metabolizable energy basis, frequently referred to, and which is relatively constant for poultry, the ingredients are listed with levels rated about fifty per cent higher for most items except fibrous foodstuffs such as bran and pollard On this basis they are given a lower value relative to wheat, e g wheat bran instead of 480 productive energy equivalent would be assessed as if it had been only 400 However, for ordinary purposes, productive energy is easy to use with mixed feeds for poultry even though metabolizable energy is more constant to express the value of individual feeds

We can take the rations from the two examples used for protein The energy level can be worked out in a similar manner to that used for checking protein level This means multiply the quantity of each ingredient by the known level per pound, and divide by the total number of pounds Units per lb for mashed grain (Ex 1) when totalled and divided by 2 for average = 838 productive energy units per lb for the 200 lb of feed (with 42 5 per cent mill offal in the ration—and wheat as grain)

The figures for the mash show the low level for mill offal (This ratio would be further reduced on metabolizable energy basis) If meatmeal was reduced to 8 lb , making a 17 per cent protein mash, then two parts mash would have to be fed with one part grain This would reduce the overall level to 766 units per lb (with approximately 60 per cent mill offal in the ration)

EXAMPLE 2 (Units of productive energy)

Mash (20 per cent protein)		*Grain* (10 per cent protein)
*76 lb crushed grain x 1020 (if wheat)	77,520	Same as for 1 if wheat, that is 1020 units per lb
†23 lb (50 per cent protein) meatmeal x 720 (+salt)	16,560	
100 lb	94 080	
therefore units per lb	940	

Average for both mash and grain (Ex 2) when totalled and divided by 2 = 980 productive energy units per lb for the 200 lb of feed

(These rations are reduced, but not significantly, in energy level when balanced with needed greenfeed or lucerne meal For example, 10 per cent lucerne meal, replacing 10 per cent of main ingredients in the mash (equivalent 5 per cent for total ration), would reduce the level by 15 in the first and 36 in the second example)

The comparisons show the importance of considering the level of energy in ingredients The consumption of feed would be very much less with the second mash (approximately 14 to 16 per cent) This reduces the total feed used *So it is vital that both protein and energy be considered to obtain the best results, and that they be in correct ratio* A suggested minimum ratio for efficiency is 42 to 1 for early stage meat raising rations (21 per cent protein x 42 = 882 units per pound of feed) with 48 or 50 to 1 for finishing stages For pullets 47 or 48 to 1 for first 6 weeks, and 55 to 1 for rearing stage For layers 58 or 62 to 1 (average of 15 per cent protein x 58 or 62 = 870 or 930 units per pound of feed) for production rates exceeding 50 per cent lay (It must be noted that this means lower protein can be used for low energy rations)

* On a purchase basis for energy level only when wheat is $50 per 2000 lb short ton ($1 50 per 60 lb bushel) maize would be a comparable buy at *approximately* $56 ($1 58 per 56 lb bushel), milo (sorghum) at $54 ($1 62 per 60 lb bushel), barley at $40 ($1 per 50 lb bushel) oats at $36 (72c per 40 lb bushel), pollard $35 05 (35c per 20 lb bushel) bran $25 (25c per 20 lb bushel)

† The higher energy level reducing total feed eaten means that the increase in meatmeal used for a given number of birds is not excessive

Note The energy levels quoted for Examples 1 and 2 would apply if de all mash by adding the grain portion as crushed grain This would e a 15 per cent protein all mash A rough ready reckoner guide to ergy level of a feed is—check the weight As all mash Example 1 would igh about 22 lb, and Example 2 about 29 lb per 4 gallon bucket

Note The term "high energy" refers to rations that have a high level of ushed grains low in fibre and have a high energy content (Inclusion of lifts the level further—should be used only if it is economic to do so) amples of these grains are wheat and maize It is important that these ains be crushed coarsely only for dry feeding use This means less bour for crushing, and trials show less feed is used and better lay tained as compared with a finely ground mixture of the same formula rds eat much less of these high energy ingredients with low fibre than gh-fibre feeds such as bran This is very apparent in cold areas or hen birds are exposed to cold winds On high energy feeds birds will put a little more weight in winter which helps give better production in is period They have given good results with all breeds and particularly ossbreds Another feature of high-energy feeds is the condition of the oppings These are drier and smaller in quantity, thus giving drier trays battery brooders or drier litter than with feeds containing a high level of an—which has a laxative effect Another point with high-energy feeds is at in meat production they produce a good-quality carcass with a high t content well finished with good pigment The gain is principally in onomy of feed used—it takes less feed to get a similar result (A low ergy may pay in some areas) Checking the prices and energy levels given r feeds will show how to mix the most economical ration, while main-ining the correct energy/protein ratio for efficient results

ECONOMICS OF BALANCING A RATION

Correct balancing of feeds enables the highest output of eggs of which e birds are capable To emphasize this point the following illustration given in the form of a scales diagram This indicates the extremes of oduction obtainable with an unbalanced grain only ration as compared ith a simple correctly balanced laying ration

FEED TO PRODUCE EGGS DECIDES PROFIT

The efficiency of poultry-farming operations under normal conditions primarily decided by the number of eggs obtained per layer

This will largely be decided by the efficient feeding of the layer A orrect balance of the minimum quantity of feed is required to maintain e bird, and allow only sufficient feed over to produce the number of ggs the breeding background of the bird makes it capable of laying This also influenced with the size of the birds used as layers The average gure shown on the scales balance diagram of 25 lb of feed for 100 birds aily to produce 200 eggs per head represents a high degree of efficiency t means that only 5 4 lb of feed is used to produce each dozen eggs (The nergy level also influences this ratio—some trials with high energy level eds show it is possible to produce one dozen eggs with 3 98 lb)

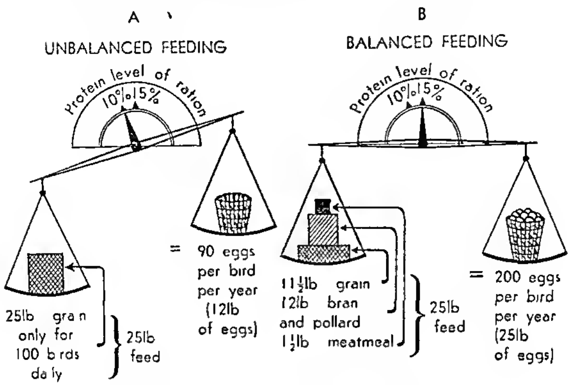


Fig 122 Example of effect of balancing a laying ration

This may appear somewhat confusing at this stage, but the method of arriving at this is shown by means of a graph (p 297) The feed required per dozen eggs produced, also the need for the production of a high level of eggs and the use of a minimum feed level for this purpose, is covered

Typical examples are given Production by the use of too high a level of feed, e g , high prices for low energy rations, increases costs per dozen

Explanation for Graph

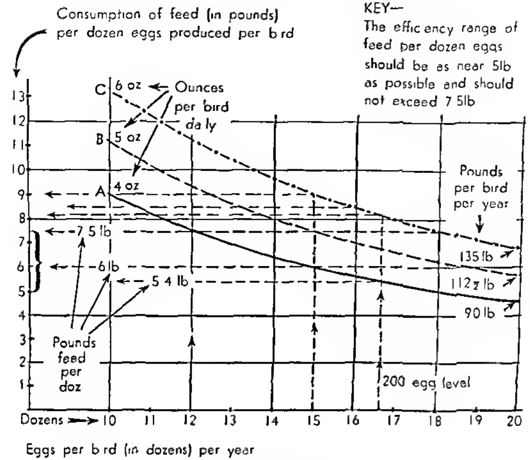
Pounds of feed per dozen eggs can be ascertained by moving straight up from the production figure selected until the appropriate feed line is reached and then straight across, which will give pounds of feed consumed per dozen eggs

The importance of a high level of performance of production can be seen and also the necessity of feed economy for a given production figure

The whole basis of poultry-farming efficiency is the feed/egg ratio Examples that illustrate these points are as follows

Example 1 A production of 12 dozen eggs per bird per year for 90 lb of feed (4 oz per bird per day) takes 7½ lb of feed per dozen eggs, while 15 dozen per bird only requires 6 lb of feed per dozen eggs With high energy feed (to give this low feed consumption level) and cost $60 per ton or 3 cents per lb this increased lay would reduce the cost of feed by nearly 4 cents per dozen eggs produced

Example 2 A production of 15 dozen eggs per bird obtained at the rate of 5 oz daily or 112½ lb per bird per year (7½ lb per dozen eggs) This could apply with low-energy feeds, free-choice feeding with waste occurring or heavy birds eating more At the feed cost quoted above of



A Feed consumed per dozen eggs when 4 oz daily or 90 lb per bird consumed per year

B Feed consumed per dozen eggs when 5 oz daily or 112½ lb per bird consumed per year

C Feed consumed per dozen eggs when 6 oz daily or 135 lb per bird consumed per year

Fig 123. Feed consumed per dozen eggs for varying feed-consumption levels and rates of production per bird

3c. per lb this would represent an increase in cost of approximately 65c If feed was used at 6 oz daily level (9 lb per dozen eggs on 15 dozen lay) 45 lb more feed would be used in a year This would be an increase in cost of $1 30 per bird. If the return received for eggs per dozen was 35c net, a gain of $1 05 would be shown in Example 1 at 4 oz level, but only 40c in the second case with 5 oz level, and a loss of 25c per bird in the third case if 6 oz. daily feed level used, even when increasing the level of production from 12 dozen to 15 dozen per bird This shows the need to save on feed consumption and waste (and the use of suitable-sized stock) to maintain an efficient feed/egg ratio.

The graph and the comparisons given stress the importance that must be attached to calculation of returns being based on eggs obtained for a given feed consumption as the true yardstick of efficiency.* Waste of feed must be controlled—wasteful hoppers, incorrectly balanced or low-energy

* A feed/egg ratio used in the United States is based on the number of pounds of feed that the net price of a dozen eggs will buy. This covers allowance for feed per dozen eggs, rate of lay, replacement and general costs A figure cited

feeds can bring about high consumption rates and increased production cost. For example, large scale production with use of a pound of feed to obtain each egg (or thereabouts) is not efficient—"buying" the eggs or extra eggs is not good business unless (possibly) a marked saving on labour can be shown.

Various comparisons can be worked out from the graph. For comparative feeding costs per bird the figure of feed consumed can be applied to the Costing the Complete Feed Ration graph (p. 289) in this chapter.

As an example 180 eggs (15 dozen) per bird average production for 90 lb. of feed costing $2.62 can show a greater profit than 216 eggs (18 dozen) per bird for 135 lb. of feed costing $3.90 per bird with eggs at 35c. per dozen net.

The aim must be by good husbandry, the right type of feed and breeding, to increase the lay per bird without increasing feed consumption. Hence when a figure of production per bird is mentioned be careful to ascertain also the feed required per dozen eggs to obtain this result in order to be able to assess its true economic importance. Tbis is quoted today in major Random Sample Tests. Some references are (p. 240)—Crossbreds in 1962-3 S.A. Random Sample Tests produced winter eggs for 3·98 lb. feed per dozen eggs; (p. 313)—Crossbreds 1960-1 S.A. Random Sample Tests produced over full year with only 4·2 lb. feed per dozen eggs. (Ration used for both tests shown p. 313.)

MINIMUM OF FEED FOR MAINTENANCE AND VARIOUS LEVELS OF LAYING

Any rate of feeding per bird very much under 4 oz. dry weight would be below maintenance and laying level combined under Australian conditions for birds large enough to lay full-sized eggs.

Many cases have been found by extension workers where increases from 10 per cent laying to 70 per cent production during the flush months in less than three weeks have been achieved. These spectacular results have occurred when birds being fed a maintenance diet of 2½ to 3 oz. daily only had their feed quantities increased to the normal level of feeding of about 4 oz. average consumption daily.

SIZE OF BIRD HAS A MARKED INFLUENCE ON FEEDING REQUIREMENTS FOR PRODUCTION

The graph that follows covers the feed level necessary for a given rate of production with birds of average total weight of approximately 4 to 5 lb. The rate of feeding is influenced by the size of the bird (and energy level of the feed). Desirable efficiency in size of layers is a bird bred large enough to lay full-sized eggs. One hundred birds of this type weighing 4 to 5 lb. average and laying 50 per cent would need approximately 25 lb.

under United States conditions is that the return for one dozen eggs should buy over 10 lb. of feed for a profit margin to exist—under efficient operation. A check on examples given here indicates that with high energy feed used, a very close costs comparison exists, and that it can also be taken as a guide to returns in Australia *and* in many other areas for commercial operations.

of feed daily, but if 6 to 7 lb. in weight would need 28 to 29 lb daily This represents an increase in consumption of feed of 10 to 14 lb per bird per year. This shows no gain—except in cull sale. (In 1960-1 R.S.T in South Australia White Leghorns ate 3·3, Crossbreds 3·7, Australorps 3·8 oz of feed per day. They weighed 4·3, 5·1, and 6·1 lb. respectively at end of test. The ration used was that shown on p. 313.) The average rate of feeding of 4 oz. per day applies for 4 to 5 lb. birds and 6 to 7 lb birds would need 4½ oz. average per day for the same rate of lay.

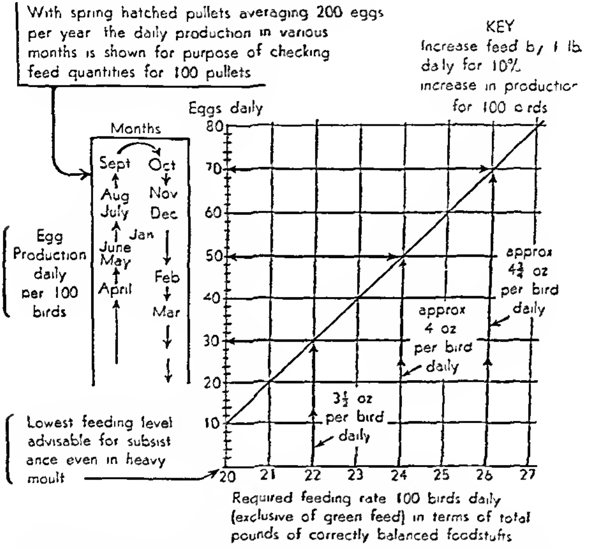


Fig. 124. Graph showing minimum quantity of feed necessary for a given rate of production with 4 to 5 lb weight birds, and a medium energy ration

Comment on Graph

A check of the graph shows that feed above maintenance level of 20 lb per 100 birds or up to 10 per cent laying daily is nearly all returned in eggs with birds weighing 4 to 5 lb.

For example, 30 per cent laying, which is just over 9 dozen eggs per bird per year, requires 22 lb. of feed daily per 100 birds, and 50 per cent laying, which is just over 15 dozen eggs per bird, requires 24 lb. daily per 100 birds as the minimum quantity of feed Nine dozen eggs weigh 13½ lb. compared with 15 dozen eggs weighing 22½ lb , which is an increase of

9 lb of eggs per bird per year The increased feeding rate of approximately 2 lb daily per 100 birds or nearly ½ oz per bird shows an increase of only approximately 8 to 9 lb of feed per bird per year for nearly 9 lb of eggs or 6 dozen eggs According to the weight per dozen of eggs laid, and energy level of the feed, from 1¼ to 1¾ lb feed is used for each extra dozen produced This illustrates the efficiency of well-bred layers in converting feed to eggs The same basis of maintenance is needed for all birds, but well-bred stock fed an adequate level of correctly balanced feed will utilize the extra feed almost entirely for eggs The basic maintenance rate is 65 to 70 lb per 4 to 5 lb bird per year (20 lb per 100 birds daily) and the efficient layer can lay 180 eggs per year when this is increased to approximately 90 lb (24 lb per 100 birds daily) and 210 eggs at approximately 95 lb of feed (25 lb per 100 birds daily)—with 10 per cent and up to 15 per cent reduction in total feed possible, when using efficient high-energy rations

PART II—SUITABLE FEEDING RATIONS FOR ALL AGES OF POULTRY

MASHES FOR YOUNG CHICKENS

Feed for chickens must be correctly balanced A good start is more than half the battle and the sample mashes shown are proven mashes that will give excellent results They are used up to six and eight weeks of age respectively All four rations compare equally for labour-saving as dry all mash mixtures

Comments are given Energy level is an important factor to consider

Note Where greenfeed is stated as necessary and none is available, lucerne meal should be added, at usual levels and also extra vitamin A given in the form of oil emulsion or powder (Refer to Feed Deficiencies pp 347-9)

TESTED BATTERY MASH NO 1*

DAY-OLD TO SIX WEEKS 4-GALLON BUCKETS AND BREAKFAST CUPS

By measure	*By weight*
Nearly 3 buckets bran	35 lb bran
Approx 1¼ buckets pollard	25 lb pollard
Approx ⅞ bucket crushed wheat	22 lb crushed wheat
Approx ⅓ bucket meatmeal (50 per cent protein)	8 lb meatmeal
Approx ⅓ bucket buttermilk powder	5 lb buttermilk powder
Approx ⅛ bucket charcoal	4 lb charcoal
2 heaped breakfast cups salt	1 lb salt
½ breakfast cup vitaminized oil emulsion	3 oz vitaminized oil 5000A 1000D, per gramme
	100 lb

* This is a low- to medium-energy ration (approx 650 units per lb) When bran and pollard price is under two thirds that of wheat in price per lb this would be then more economical than high energy ration

This mash contains approximately 17 5 per cent protein, and has been used for intensive conditions up to four weeks and then for two weeks with range rearing It is made available as free choice

In addition it is necessary to feed chaffed greenfeed, and a little crushed grain can be given daily

Comments

The battery mash illustrated has been satisfactory Chickens reared on this ration at Parafield Poultry Experiment Station, South Australia, combined with good husbandry conditions have given good results Rearing losses to six weeks under 8 per cent—to adult stage under 12 per cent Laying results have averaged well over 200 eggs per layer when tested in single and group units and with an adult mortality of only 5 to 10 per cent This indicated a satisfactory start in life (combined with a good breeding background) The chickens were on range after four weeks in hot brooders

The level of D_3* is high in this mash, and adequate for rapid growth Results with its use at this level have been excellent This allows for all absorption factors, a reasonable holding period for the mash, and covers for part consumption of crushed grain and greenfeed The increased A level† also covers possibility of loss of potency and of greenfeed shortage A small level of charcoal has been included Refer to Feed Supplements later in the chapter

Mixing the Mash

Mix the oil emulsion carefully through the bran before incorporating with the rest of the mash If somewhat sticky dilute with equal quantity of warm to hot water and then mix with bran Salt should be carefully *mixed through about half of the pollard before incorporating in the* full mash (Check re lowering salt level if meatmeal content high) Ensure that the meatmeal and milk powder are carefully mixed throughout the whole mash Mix sufficient for a week only at a time to prevent loss of value in the mash (Three hundred chickens will eat approximately 100 lb per week up to three weeks of age, and 200 lb per week from three to six weeks of age) To be fed in conjunction with chaffed greenfeed and a little crushed grain, also make some hard grit and a little (not over 1%) shell grit available (small size to be used)

Note Substitutes can be used when certain ingredients are unavailable or when the use of another product is preferred For example, powder form A and D_3 is very efficient and can be used in place of the oil emulsion, crushed oats or barley for part of the bran and pollard would improve the

* Recent overseas work also indicates a higher level of vitamin D_3 is desirable and efficient as compared with the general basis of 180 units per lb as a minimum, and 400 units per lb should be the minimum level included for chickens

† This level will more than cover the minimum requirements of 2000 2500 units of vitamin A per lb for chickens for a long period even without greenfeed If the oil used contains a low level of D_3 then use a higher quantity of the product The extra level is included to give the D_3 requirements It is much better practice to use a product with a 5 to 1 ratio for A to D_3 it also avoids excess vitamin A level effect—and cost

energy level; whey or skim milk powder could be used for buttermilk powder (but increase meatmeal 2 lb. if whey powder used). Also if extra crushed grain is used in place of bran and pollard add $\frac{1}{4}$ oz. manganese sulphate and increase meatmeal 1 lb. for every 10 lb. of bran and pollard replaced. Refer to effect of deficiencies (pp. 343-54) and for use of substitutes (pp. 337-43) for further information.

Note: If greenfeed is unavailable include 3-4 per cent lucerne meal in place of 3-4 lb. of bran—no other alteration would be needed. (The use of this ration has now been replaced by No. 3 shown on p. 303.)

TESTED BATTERY ALL MASH No. 2*

TO EIGHT WEEKS: 4-GALLON BUCKETS AND BREAKFAST CUPS

By measure	*By weight*
Approx. $1\frac{1}{4}$ buckets crushed wheat	32 lb. crushed wheat
Approx. $1\frac{1}{4}$ buckets pollard	20 lb. pollard
Approx. $1\frac{1}{4}$ buckets bran	15 lb. bran
Approx. $\frac{1}{2}$ bucket meatmeal (48 per cent protein)	15 lb. meatmeal
Approx. $\frac{1}{4}$ bucket skim milk powder ..	5 lb. skim milk powder
Approx. $\frac{1}{4}$ bucket coconut meal	5 lb. coconut meal†
Approx. $\frac{1}{8}$ bucket liver meal	3 lb. liver meal
Approx. $\frac{1}{4}$ bucket lucerne meal	5 lb. lucerne meal
1 heaped breakfast cup salt	$\frac{1}{2}$ lb. salt
$\frac{1}{2}$ breakfast cup of vitaminized oil ($2\frac{1}{2}$ oz.) ..	$2\frac{1}{2}$ oz. 5000A, 500D_3
	100 lb.

This mash contains approximately 20 per cent protein and is used for all intensive rearing to eight weeks of age. Available as dry mash at all times.

Comments

The all mash illustrated (approximately 20 per cent protein) has given very good results. Rearing losses were under 5 per cent to eight weeks of age when rearing was carried out under intensive conditions on deep litter. It has been used as above for the rearing of the random sample test pullets in the 1960-1 test at Hawkesbury Agricultural College, New South Wales, and with minor adjustment in levels for other tests. The subsequent laying results from the winning groups were very satisfactory, averaging in the vicinity of 200 eggs in twelve months. Given as dry mash available at all times. Some chaffed greenfeed can be fed in addition and some whole grain given from six weeks onwards.

The same remarks concerning substitutes and the effect of omission of any ingredients would apply as for the first battery mash shown. The same

* This is a medium-energy ration (approximately 750 units per lb.). When bran and pollard per lb. under two-thirds of wheat price it would be more economical than a high-energy ration.

† If coconut meal is not available it can be replaced by 1 lb. meatmeal and 4 lb. crushed grain.

procedure in relation to the inclusion of the vitaminized oil emulsion (this is a minimum quantity) and the salt should be adhered to

Hard-grit and shell-grit (not over 1%) should be made available

TESTED HIGH-ENERGY BATTERY ALL MASH No 3

TO SIX WEEKS 4-GALLON BUCKETS AND BREAKFAST CUPS

By measure	*By weight*
Approx $2\frac{1}{2}$ buckets crushed wheat	$55\frac{1}{2}$ lb crushed wheat
Approx nearly $\frac{1}{2}$ bucket crushed barley	10 lb crushed barley
Approx $\frac{1}{2}$ bucket crushed oats	8 lb crushed oats
Approx $\frac{2}{3}$ bucket meatmeal	17 lb meatmeal (50 per cent protein)
Approx $\frac{1}{4}$ bucket milk powder	5 lb milk powder
Approx $\frac{1}{4}$ bucket lucerne meal	4 lb lucerne meal
1 breakfast cup of salt and manganese sulphate	$\frac{1}{4}$ to $\frac{1}{2}$ lb salt and $\frac{1}{4}$ to $\frac{1}{2}$ oz manganese sulphate
$\frac{1}{2}$ breakfast cup of *5000A, 1000D₃* per gramme vitaminized oil (or equivalent level of A and D_3 powder) Addition of extra vitamin B_2 also suggested	$1\frac{1}{2}$ oz of A and D_3 powder 10,000A 2000D_3 per gramme or 3 oz vitaminized oil 5000A, 1000D_3 per gramme

To be fed dry in hoppers—give hard-grit occasionally or include $\frac{1}{2}$-1 per cent—extra greenfeed optional, and do not give shell-grit

Comments

This high-energy 18 per cent protein all mash is suitable for raising pullets under intensive conditions on floor or wire Some greenfeed can be given in addition for pullets It contains over 850 units of productive energy per lb It will show a saving on feed consumed of approximately 20 per cent as compared with ration No 1 The rate of saving in cost will be determined by the ratio of price for bran pollard and crushed grain The pullets—over 1000—in the Third S A Random Sample Test 1961-2 were reared on this ration—with under 2 per cent losses to 4 weeks of age.

Note The feeding used for raising pullets from day-old to 13 weeks in the Fourth Victorian Random Sample Test 1960-2 was similar to this type ration The weight of various ingredients is given (measurement basis can be checked by reference to high energy mash above)

"40 lb wheatmeal (crushed wheat), 10 lb ground hulled oats, 10 lb ground barley, 10 lb ground maize, 10 lb bran, 5 lb milk powder, 15 lb meatmeal (55 per cent protein), 5 lb kibbled grain, $\frac{1}{2}$ lb salt and $\frac{1}{2}$ oz manganese, plus vitamin A and D supplement Chaffed greenfeed fed in addition Excellent results have been obtained"

GROWING RATIONS FOR YOUNG PULLETS

Continued correct feeding of young pullets during that period between hot brooder and laying quarters is essential for low rearing mortality,

maximum growth and good production when they become layers Three sample rations are given that have proved suitable for the purpose Comments are given with each ration

TRIED GROWING RATION No 1*
SIX TO EIGHTEEN WEEKS, RANGE REARING

4 GALLON BUCKETS AND BREAKFAST CUPS

By measure	*By weight*
Approx 3 buckets bran	36 lb bran
Approx 1¾ buckets pollard	35 lb pollard
Approx ⅔ bucket crushed wheat	20 lb crushed wheat
Approx ⅓ bucket buttermilk powder	5 lb buttermilk powder
Approx ⅛ bucket meatmeal (50 per cent protein)	3 lb meatmeal
2 heaped breakfast cups salt	1 lb salt
	100 lb

This mash contains approximately 16 per cent protein and is used with whole grain and greenfeed The rate of mash to grain would be 2 parts mash to 1 part grain by weight or 50 lb grain (1⅔ buckets wheat or 1 bucket wheat and 1 bucket oats) to be fed with the above mash This gives a ration of approximately 14 per cent protein

Fed as a wet mash with grain (if to be used dry reduce both the pollard and bran by 12 lb —½ bucket pollard and 1 bucket bran, and increase crushed wheat by 22 lb—a full bucket) Also increase meatmeal by 2 lb This mash is suitable for good range-rearing conditions *only*

Comments

The growing mash indicated (approximately 16 per cent protein) is fed as a wet mash in conjunction with 50 per cent whole grain from six weeks

Results have been good when the mash is used as intended with good pasture and adequate range for rearing The same remarks concerning care in adding salt or any substitutes for various ingredients would apply It is sound policy to *add vitaminized oil emulsion* to the mash at the rate of 3 oz per 100 lb when using a 5000A 1000D_3 per gramme product Hard-grit and shell-grit (not over 1%) should be made available during this period (or added in the mash) Decision on use of this mash is guided by labour needs and mill offal price

The rate of growth has been good, pullets maturing well and laying at the accepted starting ages (when combined with sound husbandry)

* This is a medium-energy ration (with over 750 units of energy per lb) Check as per other rations for costs for ingredients This ration is correct for energy/protein ratio at about 55 1 and is same on this basis as No 3 (p 306) Accordingly, although lower protein level, the intake of protein is the same as for the other because the birds eat correspondingly more of this lower energy ration.

TRIED RATION No 2*

FOR REARING FROM EIGHT WEEKS FOR INTENSIVE REARING AND LAYING

4-GALLON BUCKETS AND BREAKFAST CUPS

As a Growing Mash

By measure	*By weight*
Approx $1\frac{3}{5}$ buckets crushed wheat	38 lb crushed wheat
Approx. 1 bucket pollard	20 lb pollard
Approx 1 bucket bran	12 lb bran
Approx $\frac{3}{4}$ bucket meatmeal (48 per cent protein)	20 lb meatmeal†
Approx $\frac{1}{3}$ bucket lucerne meal	5 lb lucerne meal
Approx $\frac{1}{3}$ bucket coconut meal	5 lb coconut meal
2 heaped breakfast cups salt	2 lb salt
$\frac{2}{3}$ breakfast cup of vitaminized oil	4 oz 5000A $500D_3$
	100 lb approx

This mash contains approximately 19 per cent protein and is fed with whole grain and greenfeed

The ratio of mash and grain is 2 1 by weight, as for the previous growing mash

Fed as a dry mash with grain

As a Laying Mash

When this mixture is used as a laying mash feed with just under equal quantity of grain and use as a dry mash

Comments

The growing mash indicated (approximately 19 per cent protein) has given satisfactory results for intensive-rearing conditions on deep litter It is fed in conjunction with whole grain and greenfeed Grain to mash proportion of 1 part grain to 2 parts mash by weight The overall ration is approximately 16 per cent protein Hard grit and shell-grit (not over 1 %) also to be made available This ration has given good results in the random sample laying test at Hawkesbury Agricultural College, New South Wales It has been increased in energy as compared with former basis, and as above was used for 1960-1 Test

This mash also gives very good results as a laying mash

The grain should not exceed equal parts by weight with the mash—the quantity of this mash by weight should be slightly above that of the grain to maintain a correct protein level for layers Some greenfeed is fed in addition and hard-grit and shell-grit are made available

The efficiency of the ration for this purpose is shown by the laying results of the leading groups in these tests with up to and over 200 eggs for twelve months' laying Average amount of feed used per bird for the laying stage has been about 100 lb

* This is a medium to high energy ration with about 850 units of energy per lb Check as with other rations for costs for ingredients

† If meatmeal supplies are limited replace 3 lb of meatmeal by 5 lb of milk powder and reduce bran by 2 lb

TRIED HIGH-ENERGY ALL MASH No. 3 FROM 6 WEEKS TO 18 WEEKS

4 GALLON BUCKETS AND BREAKFAST CUPS

By measure	*By weight*
Approx $2\frac{1}{4}$ buckets crushed wheat	60 lb crushed wheat
Approx $\frac{1}{4}$ bucket crushed barley	10 lb crushed barley
Approx $\frac{1}{4}$ bucket crushed oats	8 lb crushed oats
Approx $\frac{1}{4}$ bucket meatmeal (50 per cent protein)	14 lb meatmeal
Approx $\frac{1}{4}$ bucket milk powder	$3\frac{1}{2}$ lb milk powder
Approx just over $\frac{1}{4}$ bucket lucerne meal	4 lb lucerne meal
1 breakfast cup of salt and manganese sulphate	$\frac{1}{4}$ to $\frac{1}{2}$ lb salt and $\frac{1}{4}$ to $\frac{1}{2}$ oz manganese sulphate
Just under $\frac{1}{2}$ breakfast cup of 5000A 1000D_3 per gramme vitaminized oil (or equivalent level of A and D_3 powder)	1 oz A and D_3 powder 10,000A 2000D_3 per gramme or 2 oz vitaminized oil 5000A 1000D_3 per gramme
Addition of extra vitamin B_2 also suggested	100 lb approx

To be fed dry in hoppers Hard grit $\frac{1}{2}$ to 1 per cent added—or free choice No shell grit needed

Comments

This high energy 16 to 17 per cent protein all mash is suitable for feeding intensively housed pullets (on wire or deep litter) during this period It contains nearly 900 units of energy per lb Energy/protein ratio is 55 to 1—see comment p 304 It will show a saving on feed consumed of approximately 15 per cent as compared with growing ration No 1 Savings in cost will depend on comparative prices for the mashes—refer to Calculation of Energy (p 293) This was used for S A Crossbred Random Sample Test 1961-3 with only 23 per cent losses from six to 21 weeks of age when pullets intensively reared *

CORRECT FEEDING OF LAYERS

The laying ration is the most important feed as far as costs on the commercial or sideline unit are concerned It represents from 80 to 85 per cent of the feed consumed on any poultry-farm unit This varies according to whether 75% or 100% pullets are raised on the farm each year

The approach adopted is that of submitting simple basic laying rations which have been proved highly efficient Substitute feedstuffs with their protein and vitamin values known can replace the various ingredients without affecting efficiency, provided that they are included in correct proportion In some cases, where available locally at economic levels, they

* When used for rearing on well grassed range 25 lb crushed grain is added to the mixture (Under 3 per cent losses on range in S A 1961-2 R S T with this ration) If wishing to use restricted rearing practice see comment p 203 Another method is to include high level of oats—and barley—with proportionate protein reduction to maintain 55 to 1 ratio with the lower energy feed This can be used, but results have been excellent with recommended ration above

will improve the results The feedstuffs normally available in Australia are mentioned, together with the use of possible supplements Future advances in research can be expected to provide us with additional ingredients or supplements to increase efficiency economically—the information given is on the basis of knowledge and proven rations to date (This also applies to rations in Chapters 18, 19, 20 and 21)

PROVEN SIMPLE BASE RATION FOR LAYING BIRDS

The ration fed to the entries in the Hawkesbury College egg-laying competition over a long number of years consisted of 2 parts pollard, 1 part bran by weight and 7 per cent meatmeal with 1 per cent salt as the wet mash This was combined with two thirds wheat and one third maize as grain, together with ample greenfeed The total feeding rate was approximately 4½ oz per bird daily This represents the plainest feed possible, but on this simple ration an average of well over 200 eggs per bird was obtained from all birds competing in this well known official competition from 1942 to 1950

The mortality rate was also very low The protein level of the mash, owing to the quality of the ingredients available, was adequate This indicates that this simple ration can be regarded as proven and highly efficient These results have not been exceeded in recent Hawkesbury competitions Certain factors ruled in the earlier days of the industry which made feeding of the birds easier The quality of the basic products differed from many of the feedstuffs now available The grade and energy level of pollard and bran obtainable then was much higher—owing to the type of milling practices in operation not being as efficient as with present-day machinery

It has become necessary today to supplement or replace rations with crushed grains in order to adjust this factor

The only other ingredient (apart from grain and greenfeed) in this simple mash was meatmeal, and the meatmeal of the period was of a very high protein level This enabled a mash to be balanced correctly with a lower percentage of meatmeal included than is used nowadays The main alterations made in the rations outlined here, and in the references mentioned at the opening of this chapter, have been to adjust for variations in the grade and types and costs of feed available for poultry under present-day conditions *

SIMPLE BASIC RATION ADJUSTED FOR PRESENT-DAY FEEDSTUFFS

The inclusion of crushed grain to counteract lower grade pollard and bran and an increase in the level of the meatmeal enables this ration to be

* Variation in protein level in grains can upset results in laying rations Check to find out protein level if possible If, for example, grains are only 8 to 9 per cent protein then in bran and pollard mash 50 50 with grain, add 1 lb meatmeal (50 per cent protein) for each 100 lb total feed, and with crushed or all grain feeds add 2 lb per 100 lb total feed or all mash If grains are 12 to 13 per cent protein then meatmeal can be reduced by 1 lb and 2 lb respectively

balanced under present day conditions Information has been given earlier showing the method of assessing the desired protein level, and more is given later in the chapter The inclusion of other forms of protein with the meatmeal is also efficient, provided the overall level is correct Substitute foods can be used by referring to the list given so that the correct amounts are included A ration that has given very good results with the necessary adjustment made to the basic ration above is as follows

Equal parts by weight of pollard, bran and crushed wheat and 14 per cent meatmeal (50 per cent protein), 5 per cent linseed meal (30 per cent protein) with 1 per cent salt as a wet mash This is combined with wheat as grain (mash and grain 50 50 by weight) and greenfeed

As with the basic Hawkesbury ration this has been proved efficient The use of this ration over a period of five years, at the official Parafield egg-laying competition, South Australia, from 1949 to 1954 gave an average of just on 200 eggs per bird for all breeds, with over 210 eggs per bird in 1953 4 test The 1953 4 feeding rate was 96 5 lb per bird per year—just under $4\frac{1}{2}$ oz per bird daily (in spite of some waste with feeding 500 birds individually with wet mash)

The mortality rate averaged 7 per cent for the full five year period Many individual birds laid well over 275 eggs on this ration These results indicate that simple rations of this type are adequate for layers A good ration can only operate given correct husbandry conditions with the birds, and layers with a suitable breeding background Also remember that the protein and energy levels are not the only factors—as mentioned earlier there are other points—and a ration which "works" in practice is established as efficient The labour involved also has to be considered

QUANTITY OF LAYING MASH AND GRAIN NEEDED

This has been covered earlier in the chapter by means of explanation and graph The necessity of obtaining production with the minimum feed has been stressed

(Later in the chapter illustrations of measured quantities of mash, greenfeed, and grain for various rations are given for 100 birds daily The illustration should serve to clear any confusion on this aspect, and assist economical balanced feeding)

FEED REQUIREMENTS IN ADDITION TO LAYING RATION

In addition to the normal ingredients of the laying ration as mentioned for the basic rations referred to, it is necessary that ample clean water be available It is also essential that birds should have shell grit (or some other form of calcium supply such as ground limestone or oyster shell) and also hard or insoluble grit This can be given as free choice or included in the feed (Grit is covered in detail later in the chapter)

The necessity of providing greenfeed, in wet or dry form, is stressed strongly in Chapter 15 on Greenfeed It is essential to the health of stock and economy in feeding so as to preserve an efficient feed/egg ratio

SUITABLE LAYING RATIONS

The rations given are correctly balanced in order that the birds can lay the eggs their breeding background makes possible

The general basis on which the level of various ingredients is calculated is to build up the protein side but also preserve the balance of other factors necessary Wheat alone for example is high in energy but contains insufficient protein to enable a bird to produce the number of eggs it is capable of laying Hence it is necessary to introduce sufficient extra protein of the right type to achieve this result (This is shown in simplest form in the wheat and meatmeal sample ration)

The mashes set out are efficient for this purpose, and can be confidently used Where ingredients mentioned are not available for any particular reason then refer to the list of alternative feedstuffs This list covers briefly the characteristics of a number of alternative foods, and the amounts that can be incorporated to maintain a suitable ration The borderline between wet and dry mash can be taken as near 50 per cent by weight of crushed grains and bran and pollard in a ration A mixture of bran and pollard, with crushed grain forming under 40 per cent of the total ingredients, gives good results as wet mash, but may not operate well as a dry mash

When a mash has over 50 per cent of crushed grain it could still be fed as wet mash, but can be efficiently used as dry mash The nature of bran and pollard makes it suitable for a wet mash—as a dry mash it is too bulky and fine (it can in this case be a contributory cause of colds)

The sample rations cover the use of a high level of bran and pollard (low energy) through to all grains (high energy) Comments are given with each ration for additional information

PROVEN LAYING MASH

WET MASH FEEDING 4 GALLON BUCKETS AND BREAKFAST CUPS

By measure	*By weight*
Approx $2\frac{1}{3}$ buckets bran	28 lb bran
Approx $1\frac{4}{5}$ buckets pollard	28 lb pollard
Approx $1\frac{1}{8}$ buckets crushed wheat	28 lb crushed wheat
Approx $\frac{1}{2}$ bucket meatmeal	14 lb meatmeal
Approx $\frac{1}{6}$ bucket linseed meal	5 lb linseed meal
2 heaped breakfast cups of salt	1 lb salt
$\frac{1}{3}$ breakfast cup of vitaminized oil emulsion	2 oz 5000A 1000D_3
	100 lb

This mash contains approximately 19 to 20 per cent protein and is fed with 4 buckets chaffed greenfeed added to this quantity 100 lb wheat (or grains) is fed either half midday and half evening or all in the evening (50 50 basis) (100 lb wheat=$3\frac{1}{4}$ buckets)

Note The total quantity of 200 lb is the average amount of feed for 750 to 800 birds daily

TABLE 11

A READY RECKONER BASIS FO / ENERGY FEED RATIONS FOR POULTRY

(and adaptations which can be made to suit variations in feed costs and quality)
(for details of all mash rations see pages indicated)

These simple basic rations, correctly used, make possible very low production costs for eggs and meat (Future developments can be expected to indicate the use o additional supplements as they are proven economic)

Ingredients	*High Energy All Mash Rations* (for 100 lb mixture)*						*High Energy Mash with Grain Rations**			
	Pullets Day old 6 wks	*Pullets* 6 wks 18 wks	*Layers* On Floor	*Layers* *In Cages*	*Breeders* *On Floor*	*Meat Birds* (Grillers) Dayold 12wks.	*Pullets* 6 wks 18 wks	*Layers* On Floor	*Breeders* On Floor	*Meat Birds* (Roasters) 12 wks 24 wks
	(see p 303)	(see p 306)	(see p 313)	(see p 320)	(see p 319)	(pp 489 92)	—	—	(see p 319)	—
Crushed wheat	55½ lb	60 lb	66 lb	61½ lb	63 lb	47½ lb	50 lb	46 lb	32 lb	Feed as for breeders or use ration on pp 495 6
†Crushed barley	10 lb	10 lb	10 lb	9 lb	10 lb	10 lb	11 lb	12 lb	18 lb	
†Crushed oats	8 lb	8 lb	8 lb	8 lb	10 lb	10 lb	10 lb	10 lb	16 lb	
‖Meatmeal (50% protein)	17 lb	14 lb	10½ lb	10½ lb	9 lb	22 lb	18 lb	21 lb	18 lb	
Milk powder	5 lb	3½ lb	—	—	2½ lb	7 lb	5 lb	—	5 lb	
Lucerne meal	4 lb	4 lb	5 lb	5 lb	5 lb	3 lb	6 lb	10 lb	10 lb	
‡Vitamins A, D_3 and B_2	3 oz oil or 1½ oz pdr	2 oz oil or 1 oz pdr	2 oz oil or 1 oz pdr	2½ oz oil or 1¼ oz pdr	3 oz oil or 1½ oz pdr	3 oz oil or 1½ oz pdr	3 oz oil or 1½ oz pdr	4 oz oil or 2 oz pdr	6 oz oil or 3 oz pdr	
**Manganese Sulphate	¾ oz	¾ oz	¾ oz	¾ oz	½ oz	¾ ½ oz	½ oz	¾ oz	1 oz.	
*Salt	¼ ½ lb	¼ ½ lb	¼–½ lb	¼ ½ lb	¼ ½ lb	¼ ½ lb	¼ ½ lb	¼ 1 lb	¼ 1 lb	
Shell grit	—	—	Free choice	4½ lb	Free choice	—	—	Free choice	Free choice	
Hard grit	Sprinkle on feed occasionally, or include ¼ to 1% level	In hopper or include ¼ to 1% level	Free choice (or as for cage layers) to save hoppers	1½ lb (added shell grit once or twice weekly may be beneficial to cage birds)	Free choice (or as for cage layers) to save hoppers	Sprinkle on feed occasionally or include ¼ to 1% level	In hopper or include 1% in mash	Free choice (or as for cage layers but double rate)	Free choice (or as for cage layers but double rate)	
Whole grain	—	—	—	—	—	—	50 lb with above	100 lb with above	100 lb with above	
§Greenfeed	Supply optional (can reduce costs)	As for day old 6 wks	Up to 1½ gls per 100 layers daily *(optional)*	—	As for layers	—	Supply optional	Up to 1½ gls per 100 layers daily (optional)	As for layers	
Antibiotics	—	—	—	—	—	As per manufacturer s recommendation	—	—	—	—
Feeding practice	Available in *hoppers* Refill as needed	In hoppers for intensive rearing Add 25 lb crushed grain for birds when reared on grassed range	In hoppers Refill as needed—about once a week *Give 20 ft feed space for 100 layers on all mash*	In feeders This mixture very suitable for floor layers also (To adjust for breeders see p 320)	As for layers This mixture excellent for layers also	Day old 8 wks Then add 25% extra crushed grain to 12 wks for finishing stages For intensive rearing	For intensive rearing Feed 30 lb extra grain if reared on grassed range	Mash in hoppers Grain daily—approx 2 oz bird	As for layers	Dry mash and grain as for breeders, or use breeder all mash or use ration pp 495 6

should *not* be too finely ground These measures ensure freshness, economy, and save vitamin losses

† Can be increased if favourable price ratio in relation to wheat for energy level, and wheat reduced to maintain 100 lb mixture

** If grain levels are suspect, or barley level increased considerably (or maize included) then increase, particularly for chickens and breeders, manganese sulphate levels given by 50%. The level given covers for the dark type manganese sulphate, but use of this is not advisable for chickens—these require the better type product

‡ Vitaminized oil emulsion containing 5000A, 1000D_3 per gramme (use oil mixes within a week) Powder form A and D_3, containing 10,000A, 2000D_3 per gramme is easier to use, and the vitamins are more stable (See also pp 343-51) The powder can be obtained with vitamin B_2 added, and it is recommended that this be included for chickens and breeders, as lucerne meal quality, due to curing or holding methods, *may* be low in this respect Also when this applies and/or grain harvesting or holding conditions are suspect, particularly if barley level increased, then it is suggested that vitamin E be added also for chickens and breeders (These rations are suitable pure breed and crossbred breeders and chickens, but meat lines containing "game" stock may need higher vitamin and manganese levels)

§ If greenfeed used at the rate of 3 to 4 galls per 100 birds daily, could then replace lucerne meal by 4 lb crushed grain and 1 lb meatmeal, and halve oil or powder A and D_3 Alternatively in layer and breeder rations, the lucerne meal level could be increased by 50% to 100% according to purchase price and quality (A/c. general benefit and egg yolk colour)

‖ Meatmeal of 50% protein level (or higher) only should be used for chickens (Use 40% protein level meatmeal for adult birds only.) Results in rearing may vary according to meatmeal quality Substitution *in part* with vegetable protein, or liver meal, or milk powder, should improve results particularly with griller raising

¶ Salt *should not* be included in rations when bore water is given to poultry for drinking purposes In view of possible meatmeal content of salt advisable to include ¼ lb level only in all mash rations—particularly for chickens

Footnote When bran and pollard average under two-thirds the price per lb of crushed wheat they can be used to replace up to one-third of the crushed grain *in all* mash mixtures The meatmeal can be reduced 1 lb for each 10 lb of crushed grain replaced This will than be a medium energy ration It can be still used as a dry all mash, and will not, when this price variation rules, increase feed costs (Similarly, if *oats and barley levels in all mash rations owing to lower costs are increased* to marked degree *meatmeal is reduced* in same proportion, i e 1 lb for 10 lb increase to maintain correct energy/protein ratio, as the poultry eat more with the lower energy grains—or mill offals (For reference Wheat $1 50 *per bushel* (60 lb) equals barley $1 *per bushel* (50 lb) equals oats 72c. *per bushel* (40 lb) for equal energy value)

Concentrate mixtures (see also pp 315 6)

A farmer who wishes to purchase a concentrate mixture for use with his own farm grown (or purchased) grains (and thus reduce costs) can take any of the all mash rations given and arrange to have *all the ingredients other than the grains* mixed for him, *in effect, all items below the line drawn across under crushed oats* A larger mix, suitable as a concentrate for layers only, is 48 lb meatmeal (50% protein), 20 lb lucerne meal, 1-2 lb salt (omit if bore water used) 1 oz -1½ oz manganese sulphate (2 oz if high level maize or barley), 4 oz A and D_3 powder (when 10,000A, 2000D_3 per gramme rating—extra B_2 optional for layers) Free choice of grit or add 18 lb shell-grit and 6 lb hard grit needed) The mixing of concentrate mixtures *with* whole grains has given quite good results, and would suit sideline units on general farms Feed 5 to 1 (*or mix in hopper*) with grains as in all mash rations 6 or 7 to 1 with barley only and 7 or 8 to 1 with oats only (short plump oats

A ready-reckoner

Footnote To convert for Metric System 100 lb mixture equals 45 kilogrammes

- 2 2 lb equals 1 kilogramme
- pounds (lb) to kilogrammes multiply by 9/20 or (45)
- ounces (oz) to grammes multiply by 28

Comments

The proven laying mash illustrated has given excellent results This is the ration referred to earlier as used for the official egg laying competition at Parafield Poultry Station, South Australia, given daily as a wet mash Charcoal, shell grit and hard grit were made available as free choice in addition These results, and the results obtained on general farms, prove its efficiency as a simple laying ration Mixing method as under Feeding Sidelights

Note This ration combined with the greenfeed gives a medium to high energy laying ration when fed with all wheat It contains 790 to 800 units of energy per lb Refer for costs as with other rations

This method of feeding has been replaced by the high energy all mash ration listed on p 313 This has given excellent results, with slight improvement in lay, and reduced labour from 21 operations per week to once a week filling of hoppers—as no greenfeed (in wet form) or grain is given with the high energy all mash listed—*and a marked saving in feed used*

This reduces feeding costs per dozen eggs by 20 per cent on basis of 1961 prices for ingredients This has been covered in an article Where Farm Costs Can be Cut , Allan A McArdle South Australian Journal of Agriculture, April 1962, pp 404 7

This new approach to feeding has followed extensive research in the United States on energy levels of feed, and their economic values for poultry This has also been linked with protein levels, particularly by workers at Maryland University such as Professor G S Combs, and the energy/protein ratio is now a major consideration in formulating rations for efficiency The suggested ratios are listed on p 294, based upon the above work

BUCKETS AS A READY RECKONER MEASURE FOR FOOD INGREDIENTS

A ready reckoner is listed for the principal ingredients used This may help with Table 11, shown on pp 310 11

The measurements are for buckets of 4 gallon capacity (as used in most of the rations listed in this chapter) and may assist as an approximate guide The weights of different samples vary for the same ingredients, but slight variations in quantities for the bulkier items would not matter

For small items such as *vitamins—weigh or measure very carefully*

Approximate weights for 4 gallon bucket (= ½ bushel)

Wheat	30 lb	Barley meal	20 lb
Meatmeal	30 lb	Oats	20 lb
Grain sorghum	30 lb	Wheat pollard	18 lb
Linseed meal	30 lb	Coconut meal	15 lb
Maize	28 lb	Lucerne meal	10 15 lb
Peanut (or Groundnut) meal	25 26 lb	Crushed oats	13 lb
Fishmeal	24 26 lb	Rice bran	12 13 lb
Grain sorghum meal	25 lb	Wheat bran	12 lb
Maize meal	25 lb		
Barley	25 lb		
Wheat meal (crushed wheat)	22 24 lb		

(Salt would be 48 lb bone meal 32 lb , and ground limestone 64 lb —adjust for smaller measures)

PROVEN HIGH ENERGY ALL MASH FOR LAYERS

TO BE USED WITH FLOOR HOUSING SYSTEMS 4-GALLON BUCKETS AND BREAKFAST CUPS

By measure	*By weight*
3 buckets crushed wheat	66 lb crushed wheat
Just over ½ bucket crushed barley	10 lb crushed barley
½ bucket crushed oats	8 lb crushed oats
⅜ bucket meatmeal	10½ lb meatmeal (50 per cent protein)
⅜ bucket lucerne meal	5 lb good-quality lucerne meal*
1 breakfast cup salt with ¼ oz manganese sulphate	¼ to ½ lb salt ¼ to ½ oz manganese sulphate†
Just under ½ breakfast cup vitaminized oil emulsion 5000A 1000D_3 per gramme	1 oz level A and D_3 powder 10,000A 2000D_3 per gramme or 2 oz vitaminized oil emulsion 5000A 1000D_3 per gramme
	100 lb

This all mash contains 15 per cent protein and over 900 units of energy per lb and is recommended for high efficiency

This all mash ration was used in 1959 61 S A Random Sample Tests, and gave the following results All entries averaged yearly equivalent hen housed rate of lay of 203 eggs, with 4 7 lb feed used per dozen eggs laid The Crossbred entries in the 1960-1 test averaged 243 eggs yearly equivalent rate of lay with only 4 2 lb feed used per dozen eggs laid (On 1961 basis of costs the 4 2 lb at 3c per lb. cost 13c per dozen for feed) Housing was in small unit pens, each holding 10 birds These are deep litter type pens without lights (On 1961 tests this ration cost 20 per cent less per dozen eggs than ration shown on p 309)

Comments

No grain or other feed need be given with this balanced and labour-saving high energy all mash This quantity would feed 375 to 425 normal-sized layers for one day Provide ample space for this feed in the dry-mash feeders or hoppers Allow 20 feet of feeding space per 100 layers Fill hoppers once a week or fortnight Shell-grit and hard-grit should also be available in hoppers or 4½ lb shell-grit and 1½ lb hard-grit added per 100 lb

Deep litter control When all mash is fed birds may not stir the litter as often as with grain feeding Sufficient ventilation in the shed usually covers this, particularly with the drier droppings with high energy feeds and Dryden type sheds The litter can be stirred occasionally as routine practice If desired to feed some grain then 1 oz per layer could be given three days per week (alternate days), and adjust the ration by replacing 2 lb of crushed grain with 2 lb meatmeal (If wishing to feed mash and grain 50/50 see Table 11, pp 310-11)

* When fresh greenfeed is freely available at rate of 3 to 4 gallons per 100 birds daily reduce the powder or emulsion A and D_3 by half, and the lucerne meal could be left out and replaced by 4 lb crushed grains and 1 lb meatmeal

† If maize or barley used at high level, increase manganese sulphate to ¾ oz

Note As with all crushed grain feeds, crush *coarsely* and mix once a week or fortnight to keep ingredients fresh and save vitamin losses.

A further reference The feeding system used for the 1960-2 Victorian Random Sample Laying Test was similar to this—the only variation of note being that protein level was raised to make possible the feeding of 1 oz of wheat per bird daily (weights are given—refer to p 312 for measurement basis)—this feed was used from 13-weeks-old to end of laying test "58 lb wheatmeal (crushed wheat), 10 lb ground oats, 10 lb ground barley, 16 lb meatmeal (55 per cent protein), 5 lb lucerne meal, 1 lb salt with manganese Vitamin A and D supplement added Grain (wheat) fed at rate of 1 oz per bird daily Shell-grit fed *ad lib*, and chaffed greenfeed where possible (standard amount to each replicate pen)"

This has also given outstanding results (see p. 75) Reference can be made to p 305 for the laying ration used in the New South Wales Random Sample Test 1960-1

TWO RATIONS FOR GRAIN FARMS

SIMPLE WHOLE GRAIN RATION WITH MEATMEAL—FEO ORY

By measure	*By weight*	*Protein value*
Approx 3 buckets	88 lb wheat x 11% approx protein in wheat and divide by 100	9 68%
Approx ⅜ bucket meatmeal	11½ lb meatmeal x 50% protein in the particular meatmeal used and divide by 100	5 75%
1 heaped breakfast cup salt	½ lb salt including ¼ to ½ oz manganese sulphate	Nil
	100 lb	15 43%

This ration would be sufficient for 350 to 400 normal-sized laying birds for the day and is balanced for protein Feed also 4 buckets of chaffed greenfeed daily plus ½ oz A and D_3 powder 10,000A 2000D_3 per gramme (or add to the meatmeal lucerne meal ½ bucket plus 1 oz vitamin A and D_3 powder 10,000A 2000D_3 per gramme).

Comments

This ration is the simplest possible ration for laying birds It would be better with a mixture of two grains instead of wheat only. Many farms where poultry are run as a sideline give grain only with extremely poor off-season laying results Addition of meatmeal balances the ration (refer to the scales balance illustration in this chapter, p 296).

The only other adjustment needed is to add manganese sulphate and salt These are mixed with the meatmeal. Where a high level of maize or barley is used increase manganese sulphate to ½ oz.

If bore water is used on the farm then the salt *should* be left out but *not* the manganese Also have hard grit and shell-grit available for the birds—or add 1½ lb shell grit and 1½ lb hard grit—hard-grit is even more essential with this ration than any of the others

The grain can be fed in hoppers, or mixed *with* the meatmeal (which has worked well in practice), or thrown out in the litter—or straw could be spread out on the lines of the hen yard system of feeding grain outside The meatmeal can be put in a hopper or a measured quantity put out each day. As a ready-reckoner 8 measures of wheat, or 12 measures of oats (or 4 wheat and 6 oat) to 1 measure of 50 per cent meatmeal would be a balanced feed It is essential that the ample greenfeed be given with this ration or that the lucerne meal be included

Note This ration would give an energy level of nearly 950 units per lb when all wheat, but two or three grains is advised Results would be better with more balanced feeding if the meatmeal and whole grains were mixed to form an "all mash"—in this case with whole grains (This applies because more grain or meatmeal is eaten periodically than needed due to imbalance which may occur) This has worked well A 1962 trial in S A gave 82 eggs per bird for Australorps by May 31st from August 10th hatching The whole grain mixture was as for all-mash on p 313 This simple basis approach, which also *saves all crushing costs* can work well on grain farm sideline units

CONCENTRATE MIXTURES FOR USE WITH GRAINS

This is another and better feeding method on a general farm—and can also be used on commercial plants It is much more efficient than the meatmeal and grain system when free choice methods are used It could mean only the need to balance on 3 to 1 basis with some of these mixtures, compared with up to 10 to 1 with meatmeal only and grains

The first and easiest approach to formulating a concentrate mixture is to take the rations shown as all mash on pp 310-11, and everything under the line drawn beneath crushed oats is the make up of a concentrate for any stage complete—to be mixed with grains shown above the line—or fed separately

The next step is to make up the separate mixtures either on that basis, or a 30 per cent concentrate mixture, or a 39 per cent concentrate mixture, to be fed with set ratios of grains They can then be used on the same lines as for grain and meatmeal—be mixed together, or placed in hoppers or grain fed out at about 3 oz rate daily per bird Also the shell-grit and hard-grit can be included or given free choice, and either lucerne meal must be included or greenfeed given This is needed for bird health, egg yolk colour, etc. These are the types of mixtures which manufacturers can prepare (or use these as a basis with other additions) for use on grain farms—or in some cases commercial size units also The farm then supplies the grains—debiting them against the poultry at the net value received for grain on the farm It will be noted that the proportions where barley and oats are mentioned are higher—this is because the birds eat more, hence to preserve the correct energy-to-protein ratio the concentrate proportion is reduced It is stressed again, that as for the meatmeal and grain ration, whole grains can be mixed with the concentrate with good results—although the commercial operator would possibly prefer the coarsely crushed grain In the case of Asian countries the concentrate

can be used with rice (paddy) or rice bran, or both—treating these at about average of oats and barley ratios A ready-reckoner table follows (*For developing areas in particular, see also Appendix 1*)

TABLE 12

A READY RECKONER BASIS FOR COMPLETE CONCENTRATE MIXTURES

(See also pages 310 and 311)

Ingredient	*30 per cent protein concentrate mixture*		*39 per cent protein concentrate mixture*
	With mill offal	*With crushed grain*	(See also pp 310-11)
	No 1	*No 2*	*No 3*
Crushed grain	—	32 lb	—
Pollard (wheat or rice)	20 lb	—	—
Bran (wheat or rice)	15 lb	—	—
Meatmeal* (50 per cent protein)	45 lb	48 lb	48 lb
Lucerne meal†	20 lb	20 lb	20 lb
Salt (do not include if bore water used for drinking)	1 2 lb	1 2 lb	1 2 lb
Manganese sulphate‡ (commercial grade)	1 1½ oz (2 oz if used with maize or barley)	1 1½ oz (2 oz if used with maize or barley)	1 1½ oz (2 oz if used with maize or barley)
Vitamin A and D_3 powder (10 000A and 2000D_3 per gramme)	4 oz	4 oz	4 oz
Shell grit or limestone grit *and* hard (insoluble) grit	Free choice or add 18 lb shell grit and 6 lb hard grit		Free choice or add 18 lb shell grit and 6 lb hard grit
Ratio in which concentrate to be used with grains if mixed together (exclusive of the shell grit and hard grit—added after mix made)	3 to 1 with 66 wheat, 10 barley, 8 oats mixture of grains, and 4 to 1 barley only and 4½ to 1 oats only (4 to 1 with rice and paddy rice bran)		5 to 1 with 66 wheat, 10 barley 8 oats mixture of grains, 6 to 1 barley only and 7 to 1 oats only—6 to 1 with rice (paddy) and rice bran

Alternative uses of the concentrates (1) Feed in hoppers and give grain free choice in hoppers (2) Feed concentrate in hoppers and feed about 3 oz grains daily per bird (3) Mix the concentrate with the proportions shown above (by weight) with the whole grains—or coarsely ground—in same proportions

* Where meatmeal not available, use 12 lb fishmeal minimum, and make up *equivalent level of protein for balance* with peanut (ground nut) meal, and coconut meal, and/or soya bean meal, and also linseed meal can be included

† *Must* be included unless 3 to 4 gallons greenfeed daily given per 100 birds in which case can halve A and D_3 level, and replace lucerne meal level with equivalent weight mill offal or crushed grain

‡ Not needed if rice bran and pollard included, and being fed with rice bran and/or rice paddy as high proportion of grains, etc

Footnote If to be used for breeders delete 6 lb meatmeal and 4 lb crushed grain or mill offal, and replace with 10 lb milk powder, also use 5 oz A and D_3—with B_2 added, and manganese sulphate at the 2 oz level

RATIONS FOR BREEDING BIRDS

Variations in the ingredients used are necessary because a successful laying ration is not necessarily a good breeding ration (but it is very good practice to feed a breeding ration to layers, and field checks also indicate with this an increased early egg size from pullets) Breeders require a higher level of vitamins and minerals than layers This is in order to have good hatchability from eggs set, and also healthy chickens, which will start their life without nutritional deficiencies These deficiencies occur with chickens when the breeding hens are not correctly fed, so in effect the requirements of rations for the breeding hen and chickens are very similar

EXTRAS FOR BREEDING HENS AS COMPARED WITH LAYERS

The extra riboflavin required over and above that contained in the ordinary laying ration with the various ingredients such as meatmeal, bran and pollard, and crushed grains is provided by adding 3 lb of milk powder in the case of the bran and pollard mash and 5 lb of milk powder with the grain mash (pp 318-19) This is based on the use of greenfeed If no greenfeed is used lucerne meal should be included at 5 per cent level of total feed The increase in cost is not excessive Lucerne meal can usually replace mill offal or crushed grain pound for pound without cost increase, in many cases it shows a saving when allowance is made for protein saved * With milk powder—if this cost 8c per lb and if meatmeal cost 4c per lb, 5 lb of milk powder replacing 3 lb of meatmeal would only cost approximately 15c more after allowance is made for the extra 2 lb of feed replaced, and cost of equivalent riboflavin level of a synthetic product This extra cost of 15c covers 200 lb of feed (8c per 100 lb feed) Two hundred pounds of total feed would feed 800 birds for a day These could lay about 400 breeding eggs in a day, and should produce 120 to 140 pullets The cost factor is hardly worth consideration when less than the value of one extra pullet from 400 eggs covers the increase in cost as compared with layers

The milk powder possesses many beneficial vitamins etc, other than riboflavin The milk powder *and* the lucerne meal are natural sources, and when of good quality give sufficient riboflavin (Vitamin B_2) However, the lucerne meal may not always be of this grade, hence the addition of 1 to 2 p p m synthetic Vitamin B_2 is recommended It is stressed, however, that the synthetic product *only* would not give the same results, particularly under "stress" conditions

The vitamin D_3 requirements are higher than for layers and the extra cost is again very little, being less than 5c daily for 800 birds when giving extra vitamin A in proportion also At \$6 per gallon, vitaminized oil emulsion (or equivalent for powder), 5000A 1000D_3 per gramme, used at the rate of 5 oz in 200 lb of total feed, costs approximately 20c for 800 birds daily This compares with 15c daily for 800 layers (intensively housed) at 4 oz rate per 200 lb The extra manganese sulphate needed for

* For example if crushed grain \$50 per ton and meatmeal \$60 then lucerne meal included would not increase cost per lb of ration until over \$56 per ton when 5 lb lucerne meal of good quality replaces 4 lb grain and 1 lb meatmeal

200 lb of total feed costs under one cent These costs (for milk powder, Vitamin D_3 and manganese) total only about 20c These points have been stressed to show that all the extras needed (when these prices apply) for a breeding all mash cost only about 10c for each 100 lb of total feed In terms of 100 breeding birds, this means approximately 20c per week extra with costs given, for an output of over 300 eggs Without these additions these eggs may possibly hatch 100 to 150 chickens (instead of 200 to 220 chickens)—and they would be poor type chickens These points illustrate the necessity of this adjustment, and the small relative cost likely to be involved A high level of good greenfeed could supply most of the extra riboflavin necessary, but it is not wise to rely on this entirely, particularly with an all grain ration Breeding birds on free range with ample green pasture and with reasonable weather conditions *can* produce eggs that hatch high percentages of good chickens These ideal conditions are rarely available, hence use the correct breeder ration supplements at all times

Two suitable sample rations—for all bran and pollard or all crushed grain—are given

Variations in ingredients can be made—check the substitute list for suitable adjustment to preserve necessary factors and protein

Note Skim milk is an excellent ingredient—it is high in riboflavin value and could be used to mix a mash or given as a drink In the case of the first example mash, comprising bran and pollard plus protein, it could be used as mixing fluid and replace the milk powder

Feed the recommended levels of greenfeed if not available to birds on free range, or add lucerne meal in addition to the vitamin A, vitamin D_3, vitamin B_2 and manganese supplements listed (also vitamin E in cases of poor lucerne quality, etc)

TWO SAMPLE BREEDER RATIONS

1 BREEDING MASH WITH BRAN AND POLLARD (As Wet Mash)

4 GALLON BUCKETS AND BREAKFAST CUPS

By measure	*By weight*
Approx $2\frac{3}{4}$ buckets pollard	54 lb pollard
Approx $2\frac{1}{2}$ buckets bran	30 lb bran
Approx $\frac{3}{4}$ bucket meatmeal (50% protein)	12 lb meatmeal
Approx $\frac{1}{4}$ bucket buttermilk powder	3 lb buttermilk powder
2 heaped breakfast cups of salt and $\frac{1}{4}$ oz manganese sulphate	1 lb salt
$\frac{1}{4}$ breakfast cup of oil emulsion 5000A 1000D_3 per gramme	3 oz oil emulsion
	100 lb

This breeders' mash contains 19 to 20 per cent protein, to be fed with approximately equal weight of grain (100 lb) plus 4 buckets chaffed green feed If no greenfeed is available then 10 lb of lucerne meal should be added to the mash (and *double* the level of vitamins A and D_3) These are both valuable sources of riboflavin etc, and are needed at this level If neither available add 1 to 2 grammes pure synthetic riboflavin per ton of feed (1 to 2 p p m)

Note This ration gives an approximate energy level of 725 units if fed with oats and wheat as grain 50-50, and 775 units with all wheat Shell-grit and hard grit available free choice

The ration shown below is a high energy ration for birds on floor systems It is fed dry in hoppers as mash with grain on floor, or as all mash in hoppers

2 HIGH ENERGY BREEDING MASH WITH GRAIN OR AS ALL MASH

4 GALLON BUCKETS AND BREAKFAST CUPS

100 lb all mash including lucerne meal	*100 lb dry mash with 100 lb wheat, fed with greenfeed (5 buckets)*†	
*By weight**	*By measure*	*By weight*
63 lb crushed wheat	Approx 1½ buckets crushed wheat	34 lb crushed wheat
10 lb crushed oats	Approx 1¼ buckets crushed oats	20 lb crushed oats
10 lb crushed barley	Approx just over 1 bucket crushed barley	20 lb crushed barley
9 lb meatmeal	Approx ¾ bucket meatmeal (50% protein)	20 lb meatmeal
2½ lb buttermilk or skim milk powder	Approx ¼ bucket buttermilk powder	5 lb buttermilk or skim milk powder
¼ to ½ lb salt and ¼ oz manganese sulphate	2 heaped breakfast cups of salt including 1 oz of manganese sulphate	½ to 1 lb salt
3 oz vitaminized oil emulsion 5000 A 1000 D_3 per gramme or 1½ oz powder 10,000 A *2000 D_3* per gramme	Approx ½ breakfast cup of vitaminized oil emulsion 5000 A *1000 D_3* per gramme	3 oz oil or 1½ oz powder 10 000A 2000 D_3 per gramme
5 lb lucerne meal		
100 lb all mash		100 lb mash
(Check p 317 concerning Vitamin B_2)	Fed with 100 lb wheat (approx 3½ buckets) for 200 lb total feed	

* To mix the 100 lb of all mash on the left, use weights shown and adjust for measure with those given for the mash and grain as a basis

† If 10 lb lucerne meal (approximately ¾ bucket) included in place of greenfeed reduce grains by 8 lb and meatmeal by 2 lb and double vitamin A and D_3 level (as shown on p 310)

The mash and grain ration on p 319 can be converted to all-mash ration by adding the 100 lb of wheat fed as crushed grain This would give 200 lb of high energy all mash This would considerably reduce labour, and gives very good results The energy level of the total feed is approximately 900 units per lb including the greenfeed or lucerne meal

FEEDING LAYERS IN CAGES

Requirements of layers in batteries or cages are more critical than with birds housed on deep litter or on range All their needs must be catered for The protein level required is higher than for floor layers, hence the sample ration shown is just over 16 per cent protein

Feeding is on the all-mash ration with powder containing adequate A and D_3 or vitaminized oil emulsion incorporated in lieu of sunshine and greenfeed The cost, as with any all-mash rations containing a high level

DRY HIGH-ENERGY ALL MASH FOR LAYERS IN CAGES

4 GALLON BUCKETS AND BREAKFAST CUPS

By measure	*By weight*
Nearly 3 buckets crushed wheat	61½ lb crushed wheat*
Nearly ½ bucket crushed barley	9 lb crushed barley
½ bucket crushed oats	8 lb crushed oats
⅜ bucket meatmeal	10½ lb meatmeal† (50 per cent protein)
⅜ bucket lucerne meal	5 lb lucerne meal
⅛ bucket grit	4½ lb oyster limestone grit or shell-grit§
	1½ lb hard-grit
Nearly 1 breakfast cup of salt with ¼ oz manganese sulphate	⅛-¼ lb salt‡ and ¼ to ½ oz manganese sulphate
Nearly ½ breakfast cup of vitaminized oil 5000 A 1000 D_3 per gramme, or equivalent level of A and D_3 powder	1¼ oz A and D_3 powder containing 10,000 A 2000 D_3 per gramme, or 2½ oz vitaminized oil emulsion 5000 A 1000 D_3 per gramme
	100 lb (94 lb mash plus 6 lb grit)

* Replacing portion of the wheat with maize or milo would increase the energy level Check on basis of price In this case increase meatmeal by 1 lb to preserve energy protein ratio (Also if analysis for protein showed that grains were low then additional meatmeal would be needed e g if 9 per cent protein only then add 1½ lb)

† 1½ lb meatmeal and 1 lb crushed grain could be replaced by 2½ lb milk powder and increase manganese sulphate to ½ oz , and A and D_3 to 1½ oz powder —also check for vitamin B_2 This would then be a breeding ration, and also an improved laying ration—acts as aid to early lay *and* egg size with pullets

Check price levels Could be used for cages with artificial insemination practice or for floor breeders

Check reference on Substitutes for other replacements

‡ Can be reduced to ¼ lb salt or deleted according to meatmeal or water quality

§ *For cage birds* added shell grit once or twice weekly on feed *may* be beneficial

of crushed grains, may be high compared with mill offal mashes The higher energy content obtained improves feed efficiency and reduces total feed consumed thus giving cheaper feeding under most conditions Greenfeed is not usually given to battery birds, for fear of upsetting them also in view of the labour factor Lucerne meal fills this need in the all mash Greenfeed can, however, if desired, be fed when available (or as an extra) and it will, as with other systems, reduce consumption of feed (but higher lucerne meal level would be an efficient and easier method)

The sample given is a suitable battery all mash based on official and farm results in Australia Birds may consume more calcium than necessary under the system if given free choice, and also, to save containers, calcium supply as shell-grit is included in the mash at a set percentage It is also essential that hard-grit be provided Cage birds have no chance to obtain this, and its omission will adversely affect egg-shell texture and feed conversion Another factor calling for attention in a ration for cage layers is the condition of the droppings They present a sanitation problem if too liquid, also the question of fly breeding arises Control for the condition of the droppings is by a correct balance of the ingredients, which should be high-energy foods, combined with a low level of salt

The sample ration given is efficient for all areas and in winter periods

This high energy all mash contains approximately 16 per cent protein with average grain samples and good quality lucerne meal The energy level exceeds 900 units per lb (The grit portion is excluded from protein and energy basis as it is added only for convenience of supplying this with the feed) The energy or calorie protein ratio is approximately 58 to 1, which is efficient for high lay with economical feed consumption

The all mash is fed without any grain or greenfeed It is also very suitable for use with floor birds and saves the need for hoppers with shell-grit and hard-grit (This is ration on p 313 adjusted for cages)

A BASIS FOR WORKING OUT FEEDING QUANTITIES

The quantities of feed may cause some confusion where a prepared mash is purchased and is to be given to the birds The illustrations that follow, using 4-gallon buckets, show the average amounts needed for 100 birds daily of mash, grain, and greenfeed The variations for 20 per cent and 17 per cent protein mashes, and the mash and grain alteration for these cases are shown (approximate measurements for pellets are also given) They are intended only as a ready-reckoner guide—to show bulk of different ingredients and correct ratios—and not as a mixing basis

No problem is experienced with 15 per cent protein feeds, as no extra grain is needed

READY RECKONER FOR PURCHASING PREPARED FEED USED ON SIDELINE FARM

A basis for purchasing feed for a period

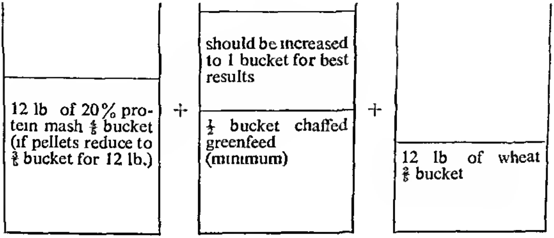
1 If 20 per cent protein mash (or pellets) are purchased, then three 120 lb bags of mash would be needed with each two 180 lb bags of wheat This amount (720 lb) would last 100 layers for a month or 400 layers for

Example 1

20% protein prepared mash (with bran and pollard) purchased or mixed on farm

Wheat containing approximately 10 to 11% protein

Mash *Greenfeed* *Grain*



Note: If oats used increase to $\frac{3}{5}$ bucket. If barley increase to $\frac{1}{2}$ bucket Adjust for other grains according to bushel weights (1 kero bucket = $\frac{1}{2}$ bushel)

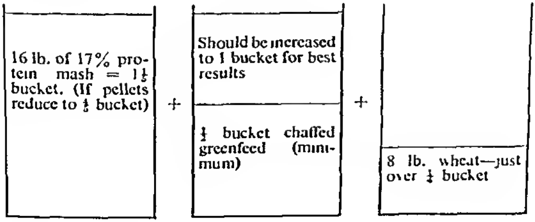
This forms a balanced laying ration of 15% protein per 100 birds daily, by using equal weights of each, but approximately 2 parts mash to 1 part wheat by measure (This is a low energy ration)

Example 2

17% protein prepared laying mash or mash mixed on farm (with bran and pollard)

Wheat containing approximately 10 to 11% protein

Mash *Greenfeed* *Grain*



Note: Adjust to $\frac{3}{8}$ bucket for oats and $\frac{3}{10}$ bucket for barley Adjust for other grains according to bushel weights (1 kero. bucket = $\frac{1}{2}$ bushel).

This forms a balanced laying ration of 15% protein per 100 birds daily by using twice the weight of mash to wheat. This means approximately three parts of mash or pellets to one part of wheat by measure. (This is a low energy ration.)

approximately one week This is based on 2 oz mash or pellets and 2 oz of grain per bird daily (Approximately 25 lb per 100 daily)

2 If 17 per cent protein mash (or pellets) purchased, then three 120-lb bags of mash would be needed with each 180 lb bag of wheat This amount (540 lb) would last 100 layers about 3 weeks or 400 layers for nearly 5½ days This is based on 2¾ oz mash or pellets and 1¼ oz grain per bird daily (Approximately 4 oz per bird or 25 lb per 100 daily)

3 If 15 per cent all mash purchased, then 6 bags (720 lb) should last 400 layers for one week (But if high energy fed may last 8 days at just under 90 lb daily)

READY RECKONER WHEN USING GRAIN GROWN ON THE FARM FOR SIDELINE POULTRY UNIT

For a general farm growing grain and using a portion for poultry an approximate ready reckoner basis of 1½ bushels (90 lb) grain for each bird can be used for the laying year, with 4 oz grain daily Approximately 10 to 11 lb of meatmeal would also be used per bird for the year, or a proportion of approximately 8 or 9 to 1 for grain to meatmeal (If concentrate mixture purchased then would include 5 lb or more of lucerne meal and ratio could be about 5-7 to 1) With a lay of 13½ dozen eggs per bird, each bushel of grain would produce about 9 dozen eggs The margin per bird for labour with a sideline unit could then be assessed by comparing the price received for 1½ bushels of grain on the farm with the net price received for 13½ dozen eggs, after deducting charges allowing for meatmeal or concentrate purchase, together with stock replacement debit and working expenses (see examples given earlier) An example could be 200 bags of wheat needed for 400 layers to produce approximately 5000 dozen eggs (less charges) in a year

FEEDING QUANTITIES FOR 100 LAYING BIRDS DAILY

A 4-gallon* bucket is used to enable comparisons of the weights and measurements of various ingredients to be made easily

In each example amounts are average quantities for 100 birds daily, and will serve as a ready reckoner basis (see graph for adjusting according to production level)

The examples are shown with greenfeed If greenfeed is not available then lucerne meal would be added to the mash (according to 5 per cent or 10 per cent level used) and it would in each case increase the bulk by one tenth or one fifth of a bucket This will be quite efficient, but if vitamin A oil or powder only were used, then the bulk of the mash may need increasing by approximately 15 to 20 per cent The basis in each example is 4 oz. of total feed for each bird daily, and when no greenfeed or lucerne meal is given this may need to be increased to 4½ with the high-energy ration, or up to 5 or 6 oz. with the lower energy level feed increasing to 1 bucket mash for 1, 1½ for 2 and ¾ for 3

* For metric system to convert gallons to litres multiply by 4½ (4 5)

Example 1

20% protein prepared mash (with bran and pollard) purchased or mixed on farm		*Wheat containing approximately 10 to 11% protein*
Mash	*Greenfeed*	*Grain*
	should be increased to 1 bucket for best results	
12 lb. of 20% protein mash $\frac{4}{5}$ bucket (if pellets reduce to $\frac{3}{5}$ bucket for 12 lb) +	$\frac{1}{2}$ bucket chaffed greenfeed (minimum) +	12 lb of wheat $\frac{2}{5}$ bucket

Note. If oats used increase to $\frac{3}{5}$ bucket If barley increase to $\frac{1}{2}$ bucket Adjust for other grains according to bushel weights (1 kero. bucket = $\frac{1}{2}$ bushel)

This forms a balanced laying ration of 15% protein per 100 birds daily, by using equal weights of each, but approximately 2 parts mash to 1 part wheat by measure. (This is a low energy ration)

Example 2

17% protein prepared laying mash or mash mixed on farm (with bran and pollard)		*Wheat containing approximately 10 to 11% protein*
Mash	*Greenfeed*	*Grain*
	Should be increased to 1 bucket for best results	
16 lb of 17% protein mash = $1\frac{1}{5}$ bucket. (If pellets reduce to $\frac{4}{5}$ bucket) +	$\frac{1}{2}$ bucket chaffed greenfeed (minimum) +	8 lb. wheat—just over $\frac{1}{4}$ bucket

Note. Adjust to $\frac{2}{5}$ bucket for oats and $\frac{1}{3}$ bucket for barley Adjust for other grains according to bushel weights (1 kero. bucket = $\frac{1}{2}$ bushel).

This forms a balanced laying ration of 15% protein per 100 birds daily by using twice the weight of mash to wheat. This means approximately three parts of mash or pellets to one part of wheat by measure. (This is a low energy ration.)

Example 3

20% protein mash of crushed wheat (or mixed grains)				*Wheat containing approximately 10 to 11% protein*
Mash		*Greenfeed*		*Grain*
Increase to $\frac{2}{3}$ bucket if crushed oats and approximately $\frac{7}{12}$ if crushed barley	+	Should be increased to 1 bucket for best results, particularly with all grains for mash	+	
12 lb of crushed wheat mash 20% protein = just over $\frac{1}{2}$ bucket		$\frac{1}{2}$ bucket chaffed greenfeed (minimum)		12 lb of wheat = $\frac{3}{8}$ bucket

Note Increase grain as for No 1 if oats, barley or other grains used

This forms a balanced high energy laying ration of 15% protein per 100 birds daily Owing to use of crushed wheat, bulk and weight are approximately equal in this example

Note To convert this example to 15 per cent protein all mash the $\frac{3}{8}$ bucket of wheat would be added as crushed grain to the mash bucket This would then make up a full bucket of all mash sufficient for 100 birds for one day

Explanation Weight of a 4 gallon bucket of mash, pellets, and grain can be seen The need for correct ratio of mash to grain is shown (The illustrations show how the volume of the mash is affected by the energy level *Use this in assessing feed value* The lower the energy the higher the bulk or fibre level) The illustrations indicate that confusion may arise with purchase of varying protein level mashes, and it is suggested that concentrate and grains as a complete mix, or the all mash ration is the best and easier approach

HOW TO WORK OUT PROTEIN REQUIREMENTS WHEN GRAINS AND MILL OFFALS ARE USED IN VARYING PROPORTIONS

The rations illustrated are samples that can be used for the main ingredient only The ready reckoner graph and discussion that follows gives a reliable basis for adjustment so that the protein level of a ration can be maintained

ENERGY LEVEL BASIS OF MASHES ON GRAPH

The level of productive energy is important as a cost factor The bran and pollard mash shown at the left of the graph, if in equal proportions, would have a productive energy level of 610 units per pound (and lower ratio compared with wheat for metabolizable energy) The all grain mash

on the right, if wheat only, would have an energy level of 940 units per pound Intermediate levels increase by about 40 units per pound for each 10 lb variation shown as grain level increases

These mashes when fed with an equal weight of grain give 15 per cent protein The grain contributes 1020 units per pound if wheat is used (refer page 293 for other grain values) When averaged with the mash this would give 815 for the bran and pollard mash with wheat, and 980 for the crushed grain mash with wheat. If the grain was crushed and mixed with the mash this would form all-mash mixtures of these energy levels The feed consumption with the higher-energy-level all mash or mash with grain would be only five-sixths of the quantity (16 per cent less) used with the other ration Under most conditions this would represent a saving on costs, unless the price of bran and pollard was under two-thirds of that of the crushed wheat (See pp 289, 293 and 313 for examples)

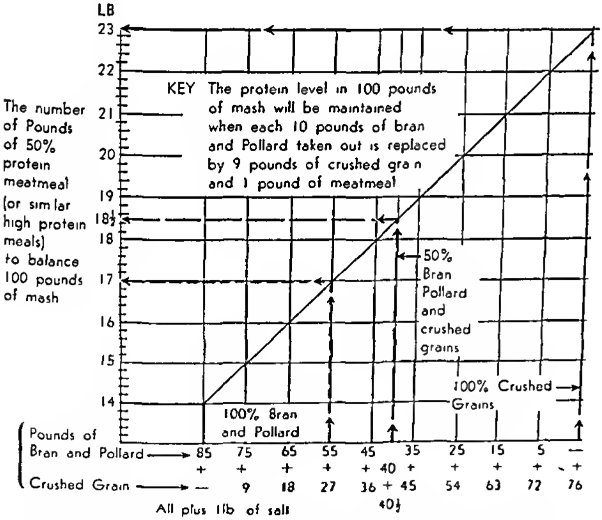


Fig 125 A ready reckoner for the meatmeal (or protein meal) level needed in 100 lb of mash to maintain a 19 to 20 per cent protein mash for varying levels of bran, pollard and crushed grain Read by moving up to line and then across

Note· Protein and Energy Relationship The graph is used to illustrate the need to adjust for protein level when the main ingredients are changed. It is also necessary to preserve the correct energy-protein ratio In these

examples the addition of 100 lb of wheat to each would work quite well, and serves the purpose intended here, but the protein level can be reduced when formulating the lower energy mixtures

This would mean 145 lb wheat with first mixture on left, giving about 13 8 per cent protein overall, 122½ lb wheat at centre giving about 14 3 per cent protein overall, and at right the 100 lb wheat would balance correctly at about 15 per cent protein overall (This also allows for lucerne meal inclusion)

The ready-reckoner basis here is—wheat reduced 5 lb for each alteration shown from left to right to preserve ratio If lower energy grains, for example oats, were used as a major portion of the added grains, then additional weight of grain is needed, and a lower protein level, to maintain the ratio The ready reckoner basis used is to take the energy level of the ration, and divide by the average for 58 to 62 (60) to give the level of protein needed For example 900 units—60 = 15 per cent protein needed and 750 units—60 = 12½ per cent protein needed (Protein/energy ration for layers 60/1)

See also pp 294, 310 2 for reference, and p 316 for variations needed with concentrate ratio to grains because of this factor.

A reference for "Inter-Relations of the Energy Content"—indicating a basis on above lines, is from G L McClymont in a paper presented to 1961 Poultry Nutrition School held at Sydney University

ADJUSTMENTS THAT CAN BE MADE FROM GRAPH

1 These mashes will give an efficient 15 per cent laying ration when combined with an equal weight of grain for laying birds

2 The graph covers intermediate levels from 100 per cent bran and pollard mash to 100 per cent crushed grain mash This will enable adjustments to be made according to the availability and price of mill offals (Adjust levels of mill offal, grains and meatmeal when lucerne meal included as with mash tables given earlier)

3 The total weight shown in each case is 99 lb, as 1 lb of salt is constant in all the mashes When the level of crushed grain in the mash exceeds 50 per cent it is necessary to include manganese sulphate

4 Where meatmeal of a higher or lower protein value is used adjust the amount accordingly A 40 per cent meatmeal would mean increasing meatmeal by one quarter and a 60 per cent meatmeal would mean reducing by one sixth The *difference to maintain 100* lb would then be adjusted on the bran, pollard, or crushed grain without appreciably altering the level of the mash In each case the meatmeal used balances 200 lb of feed with the grain (Other protein meals can replace in part)

5 The protein level will be reasonably constant at 19 to 20 per cent This cannot be given as constant in any mash, as analyses of bran, pollard, grain, and meatmeal show variations from one test to another Averages are fairly close to the figures used

TO MIX A 17 PER CENT PROTEIN MASH ON BASIS OF GRAPH

It may be desired to work out a mash on a 17 per cent protein basis, e g when bran and pollard are plentiful and cheap, and grains are dear This can be assessed by taking any desired combinations for 100 lb as shown and then adding 50 lb of crushed grain or 100 lb of bran and pollard This will give 150 lb of mash with the crushed grain addition, or 200lb of mash with the bran and pollard addition, with a 17 per cent protein level

The quantity of meatmeal required in each of these mixtures would be the amount shown on the graph for the 100 lb of mash

Examples

1 The first mash shown, 85 lb bran and pollard and 14 lb meatmeal with 50 lb of crushed grain added = 150 lb This would mean that approximately 9 lb of meatmeal per 100 lb with one-third crushed grain would give a 17 per cent protein mash

2 One hundred lb of bran and pollard added to the same bran and pollard mash quoted above would give 200 lb of mash with 14 lb of meatmeal This would mean 7 lb of meatmeal per 100 lb with bran and pollard only would give a 17 per cent protein mash (The variation is due to the higher protein of bran and pollard—15 per cent—as compared with crushed grain—11 per cent)

3 The all crushed grain mash with 50 lb crushed grain added would give 150 lb of mash with 23 lb meatmeal This would mean approximately 16 lb meatmeal per 100 lb with all crushed grain for a 17 per cent protein mash

It is necessary to keep in mind that 2 parts of these mashes by weight to 1 part of grain would have to be fed to layers to maintain the 15 per cent protein level in comparing costs. For a reference on costs of these mashes check the ready reckoner for costs of home-mixed mashes earlier in this chapter—and the energy level basis (See pp 289 95)

TO MIX A 15 PER CENT ALL-MASH RATION ON BASIS OF GRAPH

It may be desired to calculate the ingredients for a 15 per cent all mash ration, which means that no other grain would be given to the birds

In this case 100 lb of crushed grain added to any of the rations shown would give 200 lb of all mash for layers containing 15 to 15 5 per cent protein level (See p 325 for Protein/Energy Relationship comments)

DRY-MASH AND WET-MASH FEEDING

The various mash combinations shown with a high level of bran and pollard are used in wet mash For dry-mash feeding the mixtures with over and above the 50 per cent level of crushed grain are recommended for best results Manganese sulphate is used with these

CONCLUSION

The graph presentation illustrates the necessity of increasing the meat-meal when crushed grains replace mill offals to maintain protein level in a laying ration (Other items such as vitamins, minerals, lucerne meal, etc , are needed—see pp 343-54 for details)

Some of the examples shown on pp 324-7 are given below as a table per 100 lb This gives a further ready-reckoner Read across for each of 3 mashes under each protein level Refer to the sample rations for com parative weights of main ingredients on the basis of 4 gallon buckets

Grain level to be used with mash	*Protein level in 100 lb mash*	*Bran and pollard (lb)*	*Crushed grains (lb)*	*50% protein meatmeal (lb)*	*Salt*
Feed this mash with equal weight of grain	20%	85 55	 27 76	14* 17 23†	1 lb
Feed 2 parts of this mash to 1 part grain by weight	17%	92 57	 33 83	7* 9 16†	¾ lb
No grain to be fed with this all mash mixture	15%	42½ 12½	50 77 88	7* 10 11½†	½ lb

Note For mixing large quantities of mash the basis shown *for protein and main ingredients only* on the graph or table can be used by increasing the quantity in proportion See p 325 for adjustment for ratio with energy

PART III—FEED SUPPLEMENTS

USE OF ANTIBIOTICS

Many rations are advertised as containing antibiotics Various claims are made for the benefits to be obtained by their inclusion A brief summary of experimental findings as to the value of their inclusion based on work in the United States, England, and Australia will be given The observations made here are from published material by G L McClymont, formerly of Glenfield Veterinary Research Station, New South Wales, and L J Davis, Commonwealth Serum Laboratories, Melbourne, Victoria, in "Health" Journal of the Department of Health, June 1954.

* Low-energy feed ration † High-energy feed ration

Shortage of animal protein supplies in the United States stimulated research in the use of vegetable protein foods The best known there is soya bean meal, excellent in all respects except that it lacks animal protein factor or vitamin B_{12}, which is present in meatmeal, liver meal, and poultry manure The dried residues from the fermentation moulds which produce streptomycin and aureomycin containing vitamin B_{12} or the animal protein factor were added to rations containing vegetable protein Results obtained showed that the rations were equal in nutritional value to those containing animal protein (such as meatmeal or fishmeal)

Results Obtained by Usage with Poultry

1 A poor ration lacking in sufficient protein gives improved results with antibiotics added, but the protein percentage required for best results is not reduced by their inclusion It is still necessary to maintain the recommended levels of protein

2 A stimulation of growth rate is usually obtained, but not necessarily always Experiments have shown that when the surroundings of the chickens were new in all respects and sterile no response in growth was obtained Other chickens in brooders and sheds used previously gave a response in growth that brought them up to the standard of the chickens in sterile conditions

3 The increase in growth rate is confined to the early stages and an increase of 10 to 20 per cent in weight can be obtained by about 12 weeks of age with poultry, which means that the amount of feed consumed for a given weight is 10 to 15 per cent less when antibiotics are used up to this stage

4 The full development of the pullet or cockerel is no greater at maturity The gain is in the early stages only and this is "ironed out" when the poultry proceed beyond this stage

5 Mortality may be decreased in the early brooder stages when brooding conditions are not as good as desirable

6 The commencement of egg laying in pullets or the size of eggs obtained is unaffected by the use of antibiotics, and there is no economic gain for this purpose

7 The possibilities are that the stimulation of growth is obtained by the reduction of harmful bacteria, or the reduction of bacteria competing for food supplies or stimulation of the growth of bacteria that produce end-products, e g useful vitamins Another possibility cited by L J Davis is the release of accessory factors from the cells of bacteria killed by the antibiotic which would not normally be available "This theory could explain why the effect of dietary antibiotics disappears with time since obviously the susceptible bacteria are all exterminated after some weeks of feeding "

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Economic Aspect of Using Antibiotics for Poultry

1 The rate of inclusion in feed is 2 to 3 grammes of antibiotics per ton of feed or concentrates containing antibiotics at the rate of $\frac{1}{4}$ to $\frac{1}{2}$ per cent of the feed or included in the water Feeds containing antibiotics should be mixed fresh every few days

2 The cost of a feed may be increased 6 to 10 per cent by the inclusion of antibioties

3 The increased cost would not appear worth while where ordinary good husbandry is carried out with the rearing of laying pullets, as no gain is obtained With young "broilers", owing to the increase of 10 to 20 per cent in weight which may be obtained in the early stages, it is a payable proposition to include the antibiotics when selling at the "broiler" or 10 to 12 weeks stage, as the weight increase can be obtained by using up to 10 per cent less feed (Antibiotics are also used for the treatment of disease conditions—use as prescribed on diagnosis of the disease by qualified authorities See further discussion in Chapter 18 on Table Poultry)

Molasses in Poultry Ration

Nutritional authorities in overseas countries have given prominence to the benefits to be obtained by the inclusion of a small amount of cane sugar molasses in the ration An analysis of Australian molasses is cited as 3 2% crude protein, 65 64% carbohydrates, 9 63% mineral ash, and 21 53% water (It has a productive energy level of about 700)

The average mineral ash is set out as potassium oxide 33%, sodium oxide 3%, calcium oxide 14%, magnesium oxide 4%, iron oxide 3%, aluminium oxide 3% (Analysis reference R D Axam, F C S)

It is rich in essential minerals aiding health and eggshell texture Molasses is slightly laxative When blue comb disease (or uraemia) occurs in pullets the use of 2 to 3 per cent molasses in the drinking water (about half a cup to the gallon) for about a week has been recommended as treatment (see T G Hungerford, *Diseases of Poultry*) Its energy level and many valuable factors are strong recommendation for inclusion in all feeds—particularly with growing stock It can be mixed at $2\frac{1}{2}$ per cent in dry all mash without difficulty The palatability of the feed is improved by its inclusion It is cited as of value for avoidance of digestive disorders and assisting energy and stamina Higher levels up to 10% as economic can be used Many poultry-keepers have found practical results very satisfactory, and its use is recommended

MINERALS FOR POULTRY

Poultry are listed as requiring thirteen minerals The normal rations usually contain most of these minerals and deficiencies are usually likely only with calcium, phosphorus, chlorine, sodium, and manganese The requirements of poultry for manganese are high (as listed elsewhere) Where mill offals form a high percentage of the mash, and bonemeal levels are not excessive, a deficiency should not occur With all grain feeds a

deficiency exists necessitating the use of manganese sulphate (This is covered under Deficiencies) Calcium is covered by the provision of shell-grit or ground limestone, as free choice or added in the feed Salt is used to supply chlorine and sodium, but recent work reported by M W McDonald suggests care is needed, *particularly* with chickens He indicates that meatmeal may supply enough, hence only 25 per cent or less addition may suffice Usual ½ per cent in total ration with vegetable protein at high levels (When bore water is used it is left out) Salt shortage can also lead to vices such as cannibalism and feather-picking

Phosphorus deficiency will not occur with meatmeal available in normal quantities If included in small quantities some bone meal may be necessary in the feed The normal balanced rations fed to poultry will usually cover other mineral requirements Some vitamin supplements have balanced minerals added which can be of benefit (See also pp 352-4)

CHARCOAL

Much discussion centres on the use of charcoal in poultry feeds. It has no nutritional value, and it has absorption properties in relation to some vitamins Chickens receiving rations containing a small percentage of charcoal have healthy normal droppings, and no concrete evidence of disabilities due to its use has been advanced When used it would only be at a low level It is considered of value in treating enteric disorders by a possible absorption of gases The reference from T G Hungerford's *Diseases of Poultry* as to its value is "that it is widely used with good results"

FEEDING SIDELIGHTS

There are certain requirements, outside of the feeding ration, that are essential to successful feeding

SUFFICIENT FEEDING SPACE ESSENTIAL

Whether wet mash or dry mash is fed it is necessary that sufficient feeding space be made available Crowding for feed means reduced laying, more cull birds, and a possible starting of vices For wet mash feeding provide 20 feet of feeding space (and up to 25 feet) available from both sides for 100 laying birds

For dry-mash feeding allow 10 feet space where dry mash given with half feed as grain in litter, and 20 feet available from one side only when birds have all mash and obtain full needs from the hopper, for each 100 birds This would mean that a circular hopper such as a 44 gallon drum set in a tray to allow feeder space all round would give enough feed space for about 50 to 75 birds with all mash It is also very important that the feeders be designed to save waste For example 6 inch sides on the tray for 44-gallon hopper prevents any waste, but 4-inch sides may allow waste (Bottom of drum usually set 2-2½ ins up from bottom of tray) Also it is most important that waste be prevented by having the feeding lip of a

hopper for adult birds 10 to 11 inches above the ground- or litter-level Good feeders cost money—but the cost is spread over years Home built trough feeders *can* be satisfactory (See Appendix I)

CORRECT WEIGHING GOOD QUALITY FEED

When mash is being mixed on the farm or when various grains are being fed it is necessary that the correct amounts by weight be used If this is not done the complete balance of the ration can be upset by using wrong amounts in the mash, or the wrong proportions of mash to grain The rations listed have given the weights of various ingredients on a 4-gallon bucket basis The necessity for checking weights can be seen when, for example, a 4 gallon bucket of bran at 12 lb and meatmeal at 28-30 lb are compared (See p 312) Rations should be checked carefully in this respect It is wise, particularly for the variations that occur with various samples of grains and feedstuffs, to have scales in the feed shed Prepared rations can then be checked for weight in relation to energy level Examples were listed earlier in the Chapter Always make sure that feedstuffs of as good a quality as possible be obtained Poor-quality grains, reject mill offals, stale and burnt bread, and residues from food preparation factories are not good quality feeds They will usually lead to poor results —a machine must be run on good quality fuel for best results

SHELL-GRIT FOR CALCIUM* AND HARD-GRIT FOR GRINDING

It is almost universally known that poultry should have shell-grit (or ground limestone) as a source of extra calcium and this is usually made available as free choice for laying stock but can be included in the mash (refer to sample all-mash ration for battery layers) Some form of calcium supply is also essential for growing chickens (*sufficient* in an all mash when it contains 10 to 12 lb. 50 per cent protein meatmeal)

The necessity for hard grit is not as generally recognized It is natural that when poultry have ample range on land that includes some gravel or something of that nature, no attention need be paid to this When birds are housed in laying cages or deep-litter intensive units they have no chance of picking up hard-grit (unless they pick holes in the concrete floors of intensive sheds, as they sometimes do)

Lack of hard-grit makes birds eat too much soft shell grit in an endeavour to obtain grit for grinding The acids of the gizzard dissolve this quickly The excessive amount eaten can upset feeding by absorbing elements and vitamins which then become unavailable to the birds (for example, perosis in growing chickens can be caused in this way) Another result is that food is not properly utilized when hard-grit is unavailable Tests reported from overseas have indicated that birds with ample hard-grit use less food for a given purpose as compared with birds having soft-grit only—analysis of the droppings showed that a considerable wastage of food had occurred without hard grit

The gizzard is intended for grinding the food, and it cannot work efficiently without suitable hard grit This applies particularly with rations containing a high percentage of grain Hard grit should consist of hard

* Adult poultry need minimum 2 5 per cent calcium level

quantity of mixing fluid, and try and make it a point during cold weather to mix the mash with hot water. A chip heater or kerosene or electric heater is needed for this.

Note: Some sideline producers have mixed each bucket of feed as taken out. This is extremely wasteful of labour. It does not ensure a better mix and means that feeding occupies far too much time. Mash should be mixed in one lot. Drum mixing for the sideline producer can be carried out by the use of a mixing drum. This can be made cheaply and fairly simply from a 44-gallon drum. This is used to mix sufficient mash daily (with greenfeed incorporated at the rate of 2 gallons per 100 birds) for up to 800 birds. For 500 birds the mixing is easy with the drum about two-thirds full. With dry mash it mixes about 150 to 200 lb. The rate of turning is approximately 30 turns per minute.

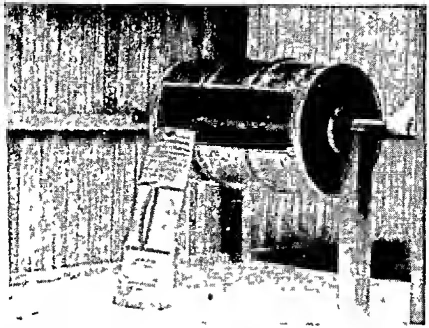

Fig. 127. A mixer constructed at reasonable cost from a 44-gallon drum. This has been used on sideline poultry units, and can mix wet mash for up to 800 birds daily (with greenfeed included). It can also be used to mix 200 lb. of dry mash.

The photograph shows details of the method of construction. The drum has an axle passing through the centre of each end and extending about 1 foot from the drum at each end. This can be galvanized water piping suitably threaded with a flange inside and outside the drum at each end. This is bolted or welded on to the drum. If desired three extra lengths of rod can be placed at equal distances from the centre axle (about 6 inches) to assist in breaking up the mash when the drum is turning. The centre axle can be carried on hardwood posts cut off about 2 foot 6 inches above floor-level. A semi-circular hole in the top corresponding to the size of the axle will carry the drum. Providing that this is kept well lubricated it makes a good bearing and turning is easy. The opening for the lid is nearly the full length of the drum (within about 3 inches of each end) and is about 12 inches wide. It will be necessary to cut the lid from another

drum so that it will lap over about 2 inches on the ends and sides It can be held in position by locking pins or bolts with wing nuts A turning handle on the end of the centre axle is necessary—about 12-inch length for the "arm" is sufficient with a handle on the end wide enough to give handgrip (Some operators have set the axle so that it passes through about 9 in from edge one end, and same distance, but opposite side, at other end This can aid "cross mixing", but makes it heavy work)

Mixing with Drum Mixer

Note All ingredients should be spread out level, as this type of drum will not mix sideways (unless adapted as mentioned above)

Place the coarse ingredients and protein in the bottom of the drum and either put on the lid and turn a few times, or mix with a mixing stick Then put in the greenfeed (or lucerne meal) and after levelling out pour on the mixing fluid For best results then put on the lid and give a few turns before adding the final fine ingredients (otherwise these can be spread on top of the greenfeed and the whole is then turned) The use of three turnings gives a better mix, but quite a good mix can be obtained with one operation The total turning time is 4 or 5 minutes (For dry mash use one operation)

Note For either hand mixing or drum mixing, if prepared mash is purchased, and it is wished to use as wet mash, the best method would be to take approximately half of the mash and the greenfeed and mix with the necessary mixing fluid Then take the balance of the mash (in place of the fine ingredients referred to above) and mix the whole together

Larger Drum Mixer

This applies where it is desired to use a larger drum mixer driven by power The general construction method can be as for the 44-gallon mixer A drum 3 feet 6 inches long and 3 feet in diameter will serve to mix the mash for 2000 birds Speed as for small drum mixer *

PROVISION FOR STORING FEEDSTUFFS

It should be possible, once a farm is established on a sound basis, or if suitable finance arrangements can be made, to store fairly large quantities of feed on the farm Possibly the avenue of co-operative buying in conjunction with other producers could be used

This can best be handled, with the lowest labour requirement, in silos, or overhead bulk bins which are available from proprietary sources with auger (or blower) filling facilities or filled from bulk feed trucks Alternatively a shed with a bin at the end 16 feet by 9 feet by 5 feet (galvanized iron sides or brick or concrete) will hold approximately 200 bags of wheat, which is sufficient total feed per 1000 birds for nearly 5 months. A similar-sized bin would hold 170 to 180 bags of oats Purchase at harvest time can often mean a very substantial saving over 12 months Poultry-farmers

* There are highly efficient proprietary mixers incorporating a mixing action which will compare with careful hand mixing for wet or dry mixtures, as the contents are turned over and also sideways, ensuring even distribution They are more efficient than the drum mixer Available as horizontal, or upright worm auger types (See Appendix 1 for comments)

will have to purchase the feed some time over the year, even if only six months' supply could be obtained ahead it could show a saving For example, 30c per bushel of 60 pounds saved by buying alternative grains at harvest time on a farm using all-grain in feeding would mean over $200 saved in six months per 1000 birds Where feedstuffs are purchased ready mixed—as with all mash—then 4 tons bulk bin storage would hold sufficient feed for 2000 birds for a fortnight

READY RECKONER FOR FEED CONSUMPTION

(1 ton = 2000 lb with poultry foodstuffs)‡

Month	*Per 1000 pullets being reared**	*Cost at $80 per ton†*	*Per 1000 loyers on form*	*Cost at $64 per ton†*
July			4½	$288
August	¾	$60	4½	288
September	1¼	100	4½	288
October	1¾	140	4½	288
November	2	160	4	256
December	2½	200	4	256
January	3¼	260	4	256
February	(then treat as layers)		4	256
March			4	256
April			4	256
May			4	256
June			4	256
Total	11½ tons	$920	50 tons	$3200

DON T CHANGE FEEDSTUFFS ABRUPTLY

The provision of ample feed on hand means that the ration for the stock can be kept constant This avoids the heavy loss of production and returns that can occur if abrupt changes have to be made For example if it can be seen that one type of grain being used is likely to run short, then a change to another grain has to be made gradually over a period of a fortnight by adding just a little more each day Even if large quantities cannot be stored, keep at least three or four weeks ahead of supplies

Note The same thought can be given to mill offals as to grains If offals are plentiful and cheap try and keep ahead The same can rule with protein Supplies are usually easier around the spring time Ten 140 pound bags of 50 per cent protein meatmeal means two to two and a half months' supply on hand per 1000 birds

* Based on day old pullets purchased August/September
† Costs can be varied to suit local prices
‡ In converting short ton of 2000 lb for metric system, the approximate equivalent is 900 kilogrammes

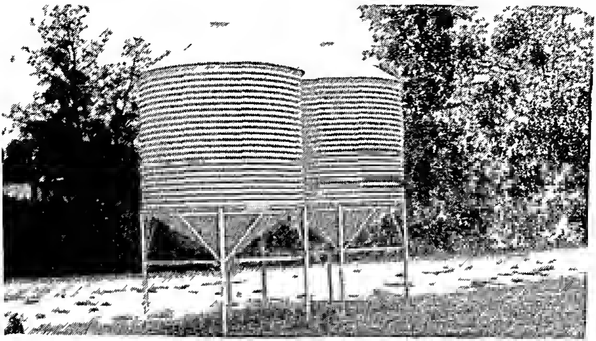

Fig 128 Silos on a poultry-farm They are auger- or blower-filled, and can be easily emptied into a vehicle for transport round the farm Grain can also be fed direct into a crusher or hammer mill by gravitation This type is also suitable for filling with prepared all mash from a bulk-feed truck with auger

ALTERNATIVE FEEDS CAN BE EFFICIENT

The same types of feedstuffs are not in plentiful supply in all parts of Australia Some feeds are confined to a certain locality or State

Difficulties of supply occur because of drought conditions, unavailability of protein supplies, and transport breakdowns These factors all combine to make it necessary that a knowledge of how to use substitute ingredients be regarded as part and parcel of handling poultry feeding This applies either to mixing on the farm or to a prepared feed manufacturer Also—and this can be very important—substitute grains could be available at a cheaper rate than the normal grain used This means that savings could be made, but are sometimes neglected because of a fear that efficiency in laying would be seriously impaired by departing from the use of a grain normally used (This does not apply—many grains give good results) The various common substitutes will be listed, with a brief description given of their value as a replacement in part or whole of other ingredients

Note A reference on costs (dealing with New South Wales for August 1954), and the savings to be effected by providing ample storage facilities for bulk purchasing and the use of substitute feeds, particularly grains, is suggested This is contained in an article, "Economies of Poultry Feeding", by A G. Bollen, Bureau of Agricultural Economics, published in the *Quarterly Review of Agricultural Economics*, October 1954

NORMAL FEEDSTUFFS AND THEIR SUBSTITUTES

Normal Grain Wheat

Wheat is the popular grain for poultry in Australia The Australian poultry industry is listed as consuming over 20,000,000 bushels annually.

It is used widely in crushed form for mashes, particularly when mill offals are scarce or high in price The various rations listed indicate the quantities and treatment necessary for feeding to poultry It is a high-energy grain, 60 lb weight per bushel (1020 units productive energy per lb)

Substitutes

(1) *Oats* Oats of good quality, small, and with very little husk have been found very satisfactory as a grain for poultry When price per lb (allowing for 40 lb per bushel as compared with 60 lb for wheat) is sufficiently under that of wheat—after allowance for 75 per cent energy level of wheat—it can be used with confidence as a fairly high proportion of the feed When crushed, oats can form a high proportion of mash Crushed oats can form 20 to 30 per cent of the ration for young pullets Official tests in New South Wales and Victoria with the use of oats as the only grain have given laying results equal to wheat The use of oats supplies roughage and digestible fibre—recommended for poultry, including turkeys, as a control for cannibalism and feather-picking A mixture of 50-50 with wheat (by weight) gives excellent results By measure this means 3 parts oats, 2 parts wheat The question of price is main factor, as with all changes in feeding A substitution of oats for wheat should be done gradually over a period of one or two weeks Its value as a grain for poultry is high

(2) *Barley* Barley has been used successfully for poultry either as the only grain or in a mixture with wheat Comparative tests with wheat have given good results Wheat, oats, and barley can be used together with good results If used 50 50 with wheat by weight, by measure should be 6 parts barley 5 parts wheat, as barley weighs 50 lb per bushel as compared with wheat at 60 lb The question of price will be the main deciding factor in comparison with other grains Allow approximately 80 per cent energy level of wheat Barley feeding is efficient, and when the price with wheat is favourable, it can be used with confidence as a grain

(3) *Maize* Cracked maize has been popular as a grain throughout Australia for many years Its use has declined in the southern States in recent years owing to its high cost Yellow maize has a noticeable effect on the colour of the yolk of eggs—it also supplies some vitamin A in the ration, but the level declines with age It has usually been fed as part of a grain mixture When price makes it economic as compared with other grains it is an excellent feedstuff It is a palatable grain (The manganese level needs adjustment when maize is used, as it contains a smaller proportion than any other grain) It has the highest energy level for a grain in terms of productive energy (1150 units productive energy per lb) It is widely used in the United States Maize can be added or substituted as shown in the listed rations On a weight basis at 56 lb per bushel maize is nearly comparable with wheat It would increase the energy level of rations listed Maize is also popular in Asian areas

(4) *Sorghum* Grain sorghum can be used in place of wheat for adult stock Milo may possibly be the best of the sorghum grains Trials in New

South Wales, Queensland, and Victoria have shown that production equal to wheat as a grain could be obtained Some work has suggested that it should not be used in chicken mashes over 15 per cent Experiments at Seven Hills Station, New South Wales, indicated that it gave poor growth and some mortality over this level, but Queensland experiments up to 60 per cent level gave satisfactory results The general recommendation would be that when the price level is below wheat it should be used as a grain, as with the other grains The weight is the same per bushel as for wheat This would apply without reservation for adult stock, but some caution may be advisable for use with chickens Its use has been covered in articles by B W Moffat and R Burton of Queensland Department of Agriculture and Stock. Milo has a high energy level (1110)—above wheat.

(5) *Rice* (paddy) Reject grains widely used for poultry in Asian countries Energy level about 770 Protein level 8 per cent to 9 per cent for average samples High manganese level Can be used with confidence at high level in the ration Small grains give good performance

(6) *Rye* Some sideline farmers, particularly in sand-drift areas where rye has been planted to control soil movement, have rye grain available It compares with wheat in composition but it is unpalatable to poultry It can also cause digestive disorders Do not include more than 25 per cent for adult birds—and not regarded as suitable for chickens

(7) *Tapioca* Crushed "chips" successfully used at high level to replace grains in Southern India

Normal Mill Offals Pollard and Bran

Pollard and bran have been the normal feedstuffs used as the basis of a laying mash as they, being a by-product, are usually cheaper than crushed grain In wet mash they form, in the majority of cases, all the ingredients except for protein For dry mash they are too bulky when fed alone They need approximately 50 per cent crushed grains added for dry feeding

Pollard has a higher food and energy value than bran—a mash normally contains twice as much pollard as bran The quality and energy level of pollard with modern machinery is below that obtained in former days, necessitating adjustment in the ration, usually by adding some crushed grain A good-quality pollard is white and heavy to handle—a poor quality looks like "ground up bran" and does not have much more weight than bran The weight of pollard should be 50 to 60 per cent higher than bran or in the proportion of 3 pollard to 2 bran for a given measure

Bran (wheat) is not normally used above 30 per cent of a laying mash If birds are fed bran only they show signs of hunger due to its low energy value, in spite of their eating a large quantity It has good properties for palatability and as a laxative (too high a proportion creates difficulty in maintaining a dry condition in chicken or laying pens)

Note When supply is possible and price level is normal pollard and bran are likely to be the basis of most wet-mash rations for laying purposes With dry mash crushed grain is considered necessary for at least 50 per

cent of the mash They are cheaper to feed than crushed wheat when pollard is under four-fifths, and bran is under half of the price per lb for wheat.

Substitutes

(1) *Crushed Grains* (wheat, oats, barley, maize) The normal substitutes used for bran and pollard are crushed grains These should only be crushed fairly coarse A mixture of grains is efficient, but a single grain can be used if it is the only one available Wheat, oats, barley, and maize can all be used Assess which grains to use on basis of price per lb in relation to energy value The addition of manganese is necessary because of the low level in grains as compared with mill offals particularly for chickens or breeding hens. The low riboflavin content is covered, with chicken and breeding stock, by adding some substance with a high level of riboflavin (such as livermeal or milk powders) An increase in protein-rich meals must also be made because of the lower protein value of grains, rated at 10 to 11 per cent protein, as shown in the various rations The nature of crushed grains makes them suitable for dry feeding, and their higher-energy level usually shows a saving in cost of feed consumed, although their price per pound may be higher than offals

Note On occasions products known as "coarse meal" and "fine meal" or "bran meal" and "pollard meal" are available through altering the milling process so that a smaller percentage of the flour is taken out. These products have a higher energy level than bran and pollard.

(2) *Rice Pollard and Bran* Rice pollard is available widely in Asia and in some areas in Australia These products can be used to a high level They are very high in manganese No supplementation would be necessary in a high percentage crushed grain mash if these comprised about 15 to 20 per cent of the mash They are also helpful in a breeding ration. Protein level 12 to 13 per cent, high in fibre Available in Asia at low cost compared with grains, and its use is strongly recommended Rations in India with over 30 per cent level have given excellent results, also in Thailand with 60 per cent inclusion in the laying test ration

(3) *Pea Meal* Can be used as a percentage of the mash, but should not exceed about 15 to 20 per cent owing to somewhat bitter taste for poultry. High in protein, approximately 22 to 23 per cent. Fifteen per cent in a 100 lb mixture of crushed grain all mash could replace 4½ lb of the 10½ lb. of 50 per cent protein meatmeal and 10½ lb of crushed grain without altering protein level. Energy level about 820. It would also give a mixture of proteins Comparative price would decide as to its use.

(4) *Potatoes.* Have a value for poultry when cooked and could be used at about 20 per cent level for wet mash If dehydrated they can be fed at the rate of up to 20 per cent of the mash

(5) *Sweet Potatoes.* Up to 20% level; fresh raw *sago* up to 30% level, reported satisfactory in papers at 1964 Poultry Convention in Queensland

Normal Protein Meatmeal

Meatmeal is the most commonly used of the sources of protein for

poultry (Many States produce high-grade products) The value is assessed in terms of percentage of protein The various rations shown have been listed with a 50 per cent meatmeal The purchase price of any meatmeal is based on its protein content One ton of 50 per cent protein meatmeal at $100 is equivalent value to $80 for 40 per cent for protein (4 lb of 50 per cent supplies equivalent protein addition in feed to that from 5 lb of 40 per cent), but its quality is higher.

Hence 5 lb of 60 per cent protein meal equals 6 lb of 50 per cent protein meal equals 7½ lb of 40 per cent protein and so on However, the grade of the meatmeal influences results—a low level of protein in meatmeal indicates too much bone in the product This excessive calcium, etc , can be a marked factor in reducing chicken growth (the major proportion of papers on Nutrition at 1964 Poultry Convention, Queensland, referred to effects of meatmeal quality) hence do not use 40 per cent protein meatmeal for chickens It can be used for laying stock Endeavour to use a high-grade meatmeal if possible—a combination of 60 per cent and 50 per cent protein to keep calcium and phosphorus at recommended levels is ideal for maximum growth Owing to a periodical and in some cases continual shortage, in some areas meatmeal has to be partly replaced with other forms of protein. This is in order and may improve results provided at least 3 per cent of meatmeal is kept as the minimum

Substitutes

(1) *Whalemeal* Whalemeal can be freely used as a complete replacement for meatmeal Its value is 60 per cent protein, and it is a high-grade product Check for comparative protein cost

(2) *Whale Solubles* (Condensed) Whale solubles are a thick brown liquid containing approximately 42 per cent crude protein This makes it difficult to handle, necessitating pre-mixing with coarse crushed grain, leaving for a day or so and then regrinding for incorporating in a dry mash With a wet mash it can be included with the mixing fluid It is necessary to include ¼ lb of bone meal or dicalcic phosphate with each 1 lb of whale solubles to adjust the phosphorus and calcium levels It has a low level of riboflavin The use of whale solubles in experiments has been referred to by G L McClymont and M W McDonald in an experiment carried out at Seven Hills Poultry Experiment Station These indicated that whale solubles could be used in chicken rations in place of meatmeal almost entirely The use of whale solubles for layers has been referred to in an experiment carried out at Parafield Poultry Station, South Australia, reported by W A Allden and M D Jones, as an efficient substitute for meatmeal

The comparative laying for a 12 months' test with White Leghorn pullets in groups of 10 was 203 average with meatmeal and 196 with whale solubles Labour involved and comparative price will be the deciding factors in the use of condensed whale solubles, coupled with the availability of meatmeal

(3) *Whale Solubles* (Spray Dried) Whale solubles in dried form became available during 1954 The protein content is 82 per cent The other factors and treatment for phosphorus, calcium, and riboflavin deficiencies

are as for condensed whale solubles Calculate for value as for meatmeal, e g 1 lb at 82 per cent equals 2 lb at 41 per cent The dried product is hygroscopic, which means that it will absorb moisture quickly once it has opened up, so open bags only as required and roll down tightly after use Store in a dry place Work carefully into a mash Keep all containers dry This product was described in detail in an article on "Spray Dried Whale Solubles' by L J Gaffney, formerly of Western Australian Department of Agriculture

(4) *Fishmeal* High grade fishmeal free of strong smells can be freely used Assess cost on basis of protein value A valuable and recommended animal protein source (also contains a high level of lysine)

(5) *Livermeal* A valuable source of protein and also riboflavin A small level at least (e g 1 lb of meatmeal in 5 lb meatmeal replaced with 1 lb livermeal) *should be included in all rations if possible* High in protein value (approximately 65 per cent) and the level of riboflavin is equal to or above milk powder The calcium and phosphorus content is low, hence adjust with bonemeal for desired level Assess cost on the basis of protein value as for meatmeal It is a very valuable source of vitamins such as niacin, pantothenic acid and choline, and amino acids such as lysine and methionine Energy level high—1100 units per lb (See also p 490)

(6) *Bloodmeal* Contains a very high level of protein (75 per cent) but it is not a good quality protein It is not palatable and is not desirable for breeding rations It can be used to replace up to 25 per cent of the meatmeal in a mash

(7) *Linseed meal* This is a valuable vegetable protein (30 per cent level) and it can replace part of the meatmeal in a laying ration It has given excellent results as 2½ per cent of the laying ration It is cited as an aid to feather lustre and growth and aids general health of layers Do not use at high level for chickens (N S W experiments indicate toxic properties for chickens at levels over 5 per cent) Assess for cost as with meatmeal

(8) *Coconut meal* Coconut meal has a protein value of 20 per cent and has a value in the mash beyond its protein level in promoting palatability, particularly in wet mash It has been successfully used up to 30% levels in rations in Asian areas Assess for value as compared with meatmeal and vegetable proteins

(9) *Peanut or groundnut meal* A very high grade product—and where obtainable can replace up to half or more of 50 per cent protein meatmeal pound for pound It is very palatable Assess for purchase value as for meatmeal It is a valuable vegetable protein, and could be widely used if available at comparable or lower price than fishmeal or meatmeal

(10) *Soya bean meal* A very valuable vegetable protein—44 per cent protein value Can be included at high level, particularly in meat raising rations Widely used in United States See also p 329 Assess for cost as with meatmeal, but as with livermeal, allow for value of desirable factors

(11) *Milk powders, buttermilk, or skim milk powders (and whey powder)* The milk powders have a value of 30 to 35 per cent protein They *should*

replace portion of the meatmeal in chicken and breeder rations Normally $2\frac{1}{2}$ per cent of the breeder ration (but more would be beneficial) and up to 10 per cent of a chicken ration is used The cost per pound is usually fairly high, but when making comparisons check for both the protein level and the riboflavin factors (referred to under Deficiencies) Milk powders also contain valuable growth and protective factors and these should be considered Use if possible

Note If whey powder is used it has a lower value for protein (about 12 per cent), but has similar growth and riboflavin factors

(12) *Skim milk* Reference has been made elsewhere in the chapter (see pp 283 and 318) When sufficient skim milk is available to mix a wet mash (approximately $\frac{1}{2}$ to $\frac{3}{4}$ gallon per 12 pounds of mash for 100 birds daily) the meatmeal level can be reduced by 25 to 35 per cent Reductions up to 50 per cent have been made with birds on good range conditions This is a valuable growth-promoting ingredient and can assist sideline farmers in particular to overcome meatmeal shortages Also if used for mixing a wet mash for breeders, no other extra riboflavin supplements would be needed With dry-mash feeding the skim milk can be given separately as a drink Maintain sanitary conditions with its use and allow water to be available also

(13) *Meat* Has a value of approximately 20 per cent protein When a regular supply of fresh meat is available it can be freely used as an excellent source of protein in part or completely Rabbits and meat scrap residue are suitable Meat would be used in wet mash only unless dried The meat can be cooked and the soup and meat used to mix the mash If dry mash fed it may have to be given separately The quantity required to maintain a given protein level in the mash would be $2\frac{1}{2}$ to 3 times by weight of 50 per cent protein meatmeal, and the other ingredients to be reduced in proportion This means that it is used as a high percentage of the mash, e g nearly 45 lb of meat would be needed in a total of 100 lb of bran and pollard mash as compared with 14 lb of 50 per cent protein meatmeal because of the lower protein rating Assess for purchase value on the cost per pound of approximately 3 lb of meat compared with 1 lb meatmeal, together with allowance for labour of handling, and the saving on other ingredients in the mash due to its greater bulk

Note To allow further adjustments for substitutes concerning protein, phosphorus, calcium fibre levels, etc , a chart is given on pp 344-5 This is Composition of Feeds from *Scientific Poultry Feeding* by G L McClymont and M W McDonald This will prove a very valuable reference

PART IV—SOME FEED DEFICIENCIES AFFECTING GROWING STOCK AND LAYING BIRDS

I LACK OF SUNSHINE (VITAMIN D_3)

A shortage of vitamin D_3, which poultry obtain in the natural way from sunlight, will cause chickens or adult birds to develop rickets This is shown by stunted growth, "rubbery" beaks and legs (they can be bent)

COMPOSITION OF FEEDS

Food Values, Mineral and Vitamin Contents

Feed	Crude protein percentage	Food unit value percentage	Crude fibre percentage	Calcium percentage	Phosphorus percentage	Manganese parts per million	Riboflavin parts per million
Protein Concentrates—							
Meatmeal	60	80	0	5.0	3.0	30.0	5.0
Meatmeal	55	73	0	8.0	4.0	30.0	5.0
Meatmeal	50	66	0	10.0	5.0	20.0	5.0
Meat and bone meal	45	60	0	14.0	6.0	14.0	4.0
Fishmeal	65	60	0	5.0	3.6		6.0
Bloodmeal	75	77	0	0.3	0.3	20.0	2.0
Livermeal	65	80	0	0.1	0.9	4.0	25.0
Condensed whale solubles	42	35	0	0.1	.	..	1·5
Skim milk or buttermilk powder	34	76	0	1.3	0.8	0.5	20.0
Dried whey	12	83	0	0.7	0.7	0.5	20.0
Peanut meal	50	75	9	0.15	0.6	40.0	2.0
Linseed meal	30	75	8	0.3	0.8	50.0	2·0
Coconut meal	20	70	10.0	0.7	0.8	50.0	2.0
Cottonseed meal	41	70	10.0	0.2	1·2	18.0	1.0
Gluten meal	43	80	2.5	0.06	0.4	4.0	1.0
Soybean meal	44	68	5.0	0.26	0.7	20.0	2.0
Grains—							
Wheat	11 (varies from 8 to 15)	72	2.5	0.04	0.3	30.0	1.0
Maize	10	76	2.0	0.01	0.3	5.0	1.0
Barley	10	65	6.0	0.05	0.4	16.0	1.0
Grain sorghum	10	75	2.5	0.04	0.3	15.0	1·0
Oats	11	60	11.0	0.06	0.2	34.0	1.0
Rye	11	70	2.6	0.05	0.4	..	1.0
Beans	22	66	4.0	0.16	0.4	13.0	1.0
Peas	23	67	6.0	0.08	0.4	30.0	1.0

Grain by-products—							
Wheat pollard	15	60	6 0	0 07	1 0	100 0	2 0
Wheat bran	15	40	10 0	0 09	1 0	100 0	2 0
Rice pollard or bran	13	50	13 0	0 1	1 8	280 0	2 0
Dried brewer s grains	25	50	15 0	0 3	0 5	20 0	8 0
Hominy meal	11	75	5 0	0 02	0 5	5 0	1 0
Miscellaneous—							
Molasses	4	50	0	0 6	0 06		5 0
Potatoes	2 (8 on dry matter)	18 (72 on dry matter)	1 0 (4 on dry matter)	0 02	0 06	3 0	0 1
Green Feeds— (On dry matter basis 1 lb dry matter equal to 3 to 4 lb of greenfeed depending on moisture content)							
Lucerne—before flowering	20	25	22 0	1 5	0 3	35 0	18 0
Lucerne—after flowering	16	20	30 0	1 2	0 2	25 0	15 0
Lucerne meal	16	25	25 0	1 4	0 2	30 0	15 0
Lucerne leaf meal	20	30	16 0	1 9	0 24	30 0	20 0
Clovers	15	22	25 0	1 1	0 2	35 0	15 0
Oats, barley, wheat (before flowering)	15	25	22 0	1 0	0 5	30 0	18 0
Oats, barley, wheat (after flowering)	10	20	30 0	0 5	0 3	25 0	8 0
Mineral Supplements—							
Ground Limestone				39 0		200 0 (varies widely)	
Shell grit				38 0			
Oyster shell				38 0			
Bone meal	15			25 0	12 0	100 0	
Dicalcic phosphate				23 0	23 0	10 0	
Manganese sulphate							
Salt							
Epsom salts						246 000	

and unsteady walking with a high stepping action This trouble may also develop where insufficient meatmeal and calcium are provided or with incorrect ratio between calcium and phosphorus Even chickens running outside may suffer from vitamin D_3 deficiency Mild cases could be due to insufficient hours of sunshine or sheltering in the shade in warm weather, so it is necessary to provide vitamin D_3 in substitute form to prevent rickets Adult stock suffering from a lack of vitamin D_3 have lowered health and increased mortality, together with a lowering of egg production, and also shell quality Field observations indicate that a high level of vitamin D_3 for chickens and adult stock is desirable, and allowance should be made for wastage and absorption factors Vitamin D_3 should be provided at all times for poultry of all ages under intensive conditions Trials at Seven Hills Experiment Station, New South Wales, reported by M W McDonald, showed 10 per cent increase in winter production with D_3 added to feed When oil emulsions used, mix feed weekly and do not hold over two weeks A longer period can be allowed with the recommended vitamin D_3 in powder form (*Vitamin D_3 is needed for poultry D_2, for example, cannot be used*) Do not hold the feed for very long periods or staleness and unpalatability of other ingredients may occur (This can also apply with grains held for excessively long periods, and particularly crushed grain—vitamin E level etc is depleted)

Note The recommendations given are for necessary levels When some sunlight is available, then a lower level of the supplement containing vitamin D_3 can be used, for example 50 per cent lower for hens on open range in spring and summer—*but add Vitamin D_3 at all times*

Vitamin D_3 Levels Required

FOR CHICKENS

Provide half a breakfast cup ($2\frac{1}{2}$ to 3 oz) of oil emulsion containing 1000 D_3 per gramme for each 100 lb of all mash Increase in proportion for oils with a lower rating per gramme For example, 1 cup of oil with 500 units D_3 per gramme would be needed These levels of emulsion will provide 700 to 800 units of D_3 per lb of feed This high level will cover all needs * Vitamin D_3 is also supplied in powder form The quantity to be given is as per the makers' recommendations to correspond to the above level of vitamin D_3 For example $1\frac{1}{4}$ to $1\frac{1}{2}$ oz of a powder product 2000 D_3 per gramme per 100 lb all mash

Note If a prepared chicken feed is used, and doubt exists as to the D_3 level or age of the feed, add up to a maximum of $\frac{1}{4}$ teaspoonful of oil emulsion 1000 D_3 per gramme level per gallon of drinking water This could apply with oil emulsion, but is very unlikely with stabilized powder

* Overseas recommendations and general field work indicate the desirability of this level of vitamin D_3 for chickens This applies more today with improved rations giving increased growth rates G Heuser of Cornell University by personal communication and in his comprehensive book, *Poultry Feeding*, states for chickens when confined add 360 A O A C units of vitamin D per pound of feed' The levels shown allow for holding the mash for a reasonable period, without falling below minimum needs Good-quality emulsions should be used, as poor-quality fish oils can cause Vitamin E deficiency problems or crazy chick disease (As indicated above powder form is recommended)

products These usually contain vitamin A and D_3 at 5 to 1 ratio They are more stable and easier to handle Some also include desirable additional vitamins, minerals and trace elements

FOR LAYERS

Provide nearly 1 cupful (4 to 5 oz) of 1000 D_3 per gramme oil emulsion per *100 lb* of mash with mash and grain feeding, or 2 to 2½ oz *in 100 lb* of all mash This will provide a level of approximately 600 to 700 units per lb of feed, which will cover all requirements D_3 powder supplements containing 2000 D_3 level per gramme can be fed at a corresponding level 1 to 1¼ oz —use others as per the makers' recommendations

FOR BREEDERS

Provide nearly a full cupful (5 oz) of 1000 D_3 per gramme emulsion for each 100 lb of mash with grain Provide 2½ oz for 100 lb of all mash This will provide a level of approximately 700 units per pound of feed

Note Vitamins A and D_3 are combined in many products available in Australia The levels incorporated in most cases give a ratio of 5 to 1 which provides ample D_3 when normal vitamin A levels recommended are used (If this did not apply excess A would have to be fed to get sufficient D_3) The *minimum* levels advised for both A and D_3 are pullets 2000 A and 400 D_3 per pound (double for "broilers") and adults 3300 A, (and up to 4500 A) and 450 to 600 D_3 per lb

2 LACK OF GREENFEED (VITAMIN A)

A shortage of vitamin A, which is supplied in natural form by greenfeed, will result in poor health and growth in chickens, and will seriously reduce egg production and health with laying stock Good greenfeed at the rate of 1½ oz per bird daily is sufficient A continued shortage over a long period will cause heavy mortality Substitutes in the form of oil or powder are often used to supply vitamin A in part in chicken rations, and in some cases this is relied upon entirely

Endeavour should be made to *feed greenfeed or lucerne meal as well as the oil or powder* Greenfeed, as referred to in Chapter 15, contains many factors not present in substitutes which contain vitamin A only Greenfeed also provides bulk in the feed and interest and occupation Ample greenfeed in wet or dry form is also helpful as a control for vitamin E problems and builds up resistance to respiratory and various deficiency diseases The oil emulsions or powders usually contain vitamin D_3 also Check for the ratio between A and D_3 in the product (See above)

The quantities of vitamin A advised as a minimum level are 2000 units of A per lb of feed for pullets, double for grillers and a minimum of 3300 units of A per lb of feed for adult stock Some authorities suggest a higher requirement than this up to 4500 units per lb for breeders, hence a 4000 basis could be used for adults A reasonable excess of vitamin A will not cause any harm Chickens will receive a sufficient level with 2½-3 oz of 5000 A per gramme oil emulsion per 100 lb of total feed, and adult stock fed mash with grain 50-50 would need 4 to 6 oz in the mash per 100 lb

and unsteady walking with a high stepping action This trouble may also develop where insufficient meatmeal and calcium are provided or with incorrect ratio between calcium and phosphorus Even chickens running outside may suffer from vitamin D_3 deficiency Mild cases could be due to insufficient hours of sunshine or sheltering in the shade in warm weather, so it is necessary to provide vitamin D_3 in substitute form to prevent rickets Adult stock suffering from a lack of vitamin D_3 have lowered health and increased mortality, together with a lowering of egg production, and also shell quality Field observations indicate that a high level of vitamin D_3 for chickens and adult stock is desirable, and allowance should be made for wastage and absorption factors Vitamin D_3 should be provided at all times for poultry of all ages under intensive conditions Trials at Seven Hills Experiment Station, New South Wales, reported by M W McDonald, showed 10 per cent increase in winter production with D_3 added to feed When oil emulsions used, mix feed weekly and do not hold over two weeks A longer period can be allowed with the recommended vitamin D_3 in powder form (*Vitamin D_3 is needed for poultry D_2, for example, cannot be used*) Do not hold the feed for very long periods or staleness and unpalatability of other ingredients may occur (This can also apply with grains held for excessively long periods, and particularly crushed grain—vitamin E level etc is depleted)

Note The recommendations given are for necessary levels When some sunlight is available, then a lower level of the supplement containing vitamin D_3 can be used, for example 50 per cent lower for hens on open range in spring and summer—*but add Vitamin D_3 at all times*

Vitamin D_3 Levels Required

FOR CHICKENS

Provide half a breakfast cup ($2\frac{1}{2}$ to 3 oz) of oil emulsion containing 1000 D_3 per gramme for each 100 lb of all mash Increase in proportion for oils with a lower rating per gramme For example, 1 cup of oil with 500 units D_3 per gramme would be needed These levels of emulsion will provide 700 to 800 units of D_3 per lb of feed This high level will cover all needs * Vitamin D_3 is also supplied in powder form The quantity to be given is as per the makers' recommendations to correspond to the above level of vitamin D_3 For example $1\frac{1}{4}$ to $1\frac{1}{2}$ oz of a powder product 2000 D_3 per gramme per 100 lb all mash

Note If a prepared chicken feed is used, and doubt exists as to the D_3 level or age of the feed, add up to a maximum of $\frac{1}{2}$ teaspoonful of oil emulsion 1000 D_3 per gramme level per gallon of drinking water This could apply with oil emulsion, but is very unlikely with stabilized powder

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products These usually contain vitamin A and D_3 at 5 to 1 ratio They are more stable and easier to handle Some also include desirable additional vitamins, minerals and trace elements

FOR LAYERS

Provide nearly 1 cupful (4 to 5 oz) of 1000 D_3 per gramme oil emulsion per 100 lb of mash with mash and grain feeding, or 2 to $2\frac{1}{2}$ oz in 100 lb of all mash This will provide a level of approximately 600 to 700 units per lb of feed, which will cover all requirements D_3 powder supplements containing 2000 D_3 level per gramme can be fed at a corresponding level 1 to $1\frac{1}{4}$ oz—use others as per the makers' recommendations

FOR BREEDERS

Provide nearly a full cupful (5 oz) of 1000 D_3 per gramme emulsion for each 100 lb of mash with grain Provide $2\frac{1}{2}$ oz for 100 lb of all mash This will provide a level of approximately 700 units per pound of feed

Note Vitamins A and D_3 are combined in many products available in Australia The levels incorporated in most cases give a ratio of 5 to 1 which provides ample D_3 when normal vitamin A levels recommended are used (If this did not apply excess A would have to be fed to get sufficient D_3) The *minimum* levels advised for both A and D_3 are pullets 2000 A and 400 D_3 per pound (double for "broilers") and adults 3300 A, (and up to 4500 A) and 450 to 600 D_3 per lb

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Endeavour should be made to *feed greenfeed or lucerne meal as well as the oil or powder* Greenfeed, as referred to in Chapter 15, contains many factors not present in substitutes which contain vitamin A only Greenfeed also provides bulk in the feed and interest and occupation Ample greenfeed in wet or dry form is also helpful as a control for vitamin E problems and builds up resistance to respiratory and various deficiency diseases The oil emulsions or powders usually contain vitamin D_3 also Check for the ratio between A and D_3 in the product (See above)

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and with all mash 2½ to 3 oz per **100 lb** feed These examples cover requirements when no greenfeed or lucerne meal is given (but use if possible—lucerne meal is easiest) When ample good quality greenfeed is available no substitute *may* be needed, but in the winter period in particular or with poor quality greenfeed add the substitute at half these rates This should be used at all times Powder would be used in preference to oil emulsion—check for a comparable level of vitamin A units per lb of feed *Hence, add Vitamin A at all times*

Vitamin A Levels Required

FOR CHICKENS

One half of a cupful (approximately 2½ oz) of oil emulsion containing 5000 A per gramme used per 100 lb of total feed gives 3500 units per lb and will cover requirements of vitamin A for rearing replacement stock Vitamin A is also supplied in powder form The quantity to be fed is as per the recommendations given by the makers of the particular product used Check for a comparable level of vitamin A to that shown above, e g 1½ oz if 10,000 A per gramme (Over 4000 units vitamin A per lb of feed advised for cockerels on high-protein and high energy feeds)

FOR LAYERS

Approximately 1 cupful (4 to 5 oz) of 5000 A per gramme oil emulsion in 100 lb of mash when fed with grain 50 50 or 2 to 2½ oz in 100 lb of all mash will supply a level of 3500 units of A per lb of feed Powder supplements containing vitamin A can be fed as per makers' recommendations to correspond with this level, e g 10,000 A per gramme product 2 to 2½ oz in mash with grain or 1 to 1¼ oz in all mash

FOR BREEDERS

Five to six ounces of the above oil needed to give over 4000 units per lb of mash or 2½ to 3 oz per lb of total feed and with above powder this would be 1½ to 1½ oz in all mash

Note The recommendations for emulsion or powder level apply when no greenfeed is given When good quality young greenfeed is given in reasonable quantity, then reduce amount given, for example, ½ 4 gallon bucket greenfeed per 100 adults daily can reduce the level needed by 50 per cent When lucerne meal is included in the ration and is of very high quality—such as fresh dehydrated lucerne meal—it could supply sufficient vitamin A, but it is good practice to include the 50 per cent rate of oil or powder If using sun dried lucerne meal and the age is not known it is safest to feed from 75 per cent up to the normal level in the mash, that is 2 to 2½ oz of 5000 A per gramme product per 100 lb of total feed for adult birds

Note The use of lucerne meal of this type may also affect the level of other vitamins in the greenfeed—e g vitamin K and in particular vitamin E In seasons when harvesting conditions affect the level in the grains, and lucerne meal—usually a very rich source of vitamin E—is not a high grade product, deficiency may occur This can be prevented by

addition of vitamin E in synthetic form as per manufacturer's recommendation

How to Calculate Vitamin A and D_3 Needs

As an example, a synthetic product may have a stated level of 5000 units of vitamin A per gramme This represents 142 000 units per ounce (28 4 grammes = 1 ounce) To provide a level of 3300 units of vitamin A stated per pound for hens 330,000 units of vitamin A will be required in each 100 lb of mixture Dividing 330,000 by 142,000 per ounce shows that $2\frac{1}{2}$ oz gives a safe margin If the product also contains 1000 units of vitamin D_3 per gramme, then with the 5 to 1 ratio this would automatically provide 660 units of D_3 per pound of feed, 450 units of D_3 is stated as the level for hens, hence this allows a good margin When part level is to be used, as with greenfeed, particularly if poor quality or in short supply $1\frac{1}{4}$ to $1\frac{1}{2}$ oz per 100 lb of feed is sufficient

(If using a product with 10 to 1 ratio of A to D_3, then more A than needed would be used to give the 450 D_3 level—approximately $3\frac{1}{4}$ oz, thus giving 4500 A and 450 D_3 when containing 5000 A 500 D_3 per gramme This would increase costs, as vitamin A costs much more than vitamin D_3 If birds were running in sunshine, then $2\frac{1}{2}$ oz, giving a 330 D_3 level could be sufficient, but not in the winter or with intensive housing conditions These rates are for a complete or all mash mixture—use double the level in the mash when mash fed with an equal weight of grain)

Chickens are stated as needing 2000 units of vitamin A per pound of feed This would mean the use of a 5 to 1 product, containing 5000 A 1000 D_3 per gramme at $1\frac{1}{2}$ oz level per 100 lb of total feed to provide 400 units of D_3 per pound This allows a fairly safe minimum margin for most farm conditions—but many operators increase this level If a product contains 10,000 A 2,000 D_3 per gramme, then of course only half the quantities would be needed in each case (This type of stabilized powder product is the popular choice today, with each ounce adding 2840 units of A and 568 units of D_3 to the ration when 100 lb mixture)

This gives a basis for checking levels needed with the use of vitamins A and D_3 supplements in poultry rations

3 OMISSION OF MILK POWDERS (VITAMIN B_2)

A high level of riboflavin (vitamin B_2) is available when either skim milk powder, buttermilk powder, whey powder (or livermeal), and good greenfeed or lucerne meal are made available to chickens Omission will lead to poor growth, curled toe paralysis and leg weakness This will be avoided if the ingredients of the mash include these at sufficient level A minimum of 5 per cent milk powder should be used (Results will be improved by increasing the milk powder level to 7 or 8 per cent) Some operators supply riboflavin in synthetic form in chicken mash, on the score of cost This should not comprise the whole of the supply, even though it is sound practice to use this to provide additional riboflavin The use of these substitutes only can prove to be expensive economy Under stress conditions they cannot meet the needs of chickens, as possible with milk

powders Five pounds of buttermilk powder will supply sufficient extra riboflavin in the mash even with a high level of crushed grains included when greenfeed (wet or dry) is used When the price is say, 6c per lb the approximate cost of 5 lb of milk powder would be 30c This would appear costly as compared with, for example, 5c for a synthetic substitute, but this is not the whole picture When 5 lb of milk powder is included it saves

(*a*) Three pounds of meatmeal—because 5 lb of milk powder at 30 to 35 per cent protein is equivalent to 3 lb of 50 per cent protein meatmeal The value of 3 lb of meatmeal at 3c per lb would be approximately 10c, hence 10c saved on meatmeal

(*b*) Two pounds of bran and pollard or crushed grain is also saved in holding the bulk of the mash At $50 per ton this would be approximately 5c saved This means a total of synthetic riboflavin 5c plus meatmeal 10c plus mill offals or crushed grain 5c = 20c

Therefore the extra cost for 5 per cent milk powder is 10c per 100 lb of total feed, when these prices rule—adjustment can be made for local costs

The use of the 5 per cent milk powder in the growing mash (or 3½ per cent in total feed) at these prices to five or six months of age, when approximately 20 to 22 lb of feed has been consumed by a pullet, would be under 2c extra per pullet

This is a very sound investment by virtue of valuable growth and resistance factors in milk powder in addition to riboflavin It is an ' insurance policy ' for raising young stock A substitute contains riboflavin only without the other factors Milk powder has been shown as a valuable weapon in building resistance to coccidiosis in growing chickens A Queensland report of a trial states that chickens at one month of age were experimentally infected with coccidiosis, when half had been reared with milk powder, and half without milk powder in the ration The death rate (without any treatment being given) was 33 per cent where milk powder had been fed to the chickens and 76 per cent where no milk powder had been fed (Trial reported by F N Milne and P J O Sullivan)

As with greenfeed unknown factors are also involved The cost of milk powder is not significant in view of the many benefits from the inclusion of this essential ingredient in chicken and breeding rations

Whey powder is equally valuable in all respects except protein This would be adjusted by including 2 extra lb of meatmeal in 100 lb of mash (and reducing the grain proportion by 2 lb) The extra cost would be only the difference between the average price for meatmeal and grain

Note These levels of milk powder are based on good quality greenfeed, with its high riboflavin content, or a comparable level and quality of lucerne meal being fed to the stock If this is not available, or the lucerne meal is of poor quality, then a higher level is needed Alternatively, if milk powder is costly, the basic 5 per cent is used, and the extra is added as synthetic riboflavin The usual addition is 1½ to 2 p p m, and it is a sound practice as a safeguard—this would be in addition to the basic 5 per cent of milk

powder—not in place of same Accordingly, its inclusion is recommended as a sound low cost precautionary measure

Milk Powder Levels Required

Include a minimum of 5 lb (nearly $\frac{1}{3}$ of a 4-gallon bucket) and up to 8 lb (half a bucket) if possible of skim, buttermilk, or whey powder in 100 lb of chicken mash in the first 6 weeks, and 5 lb in mash with grain fed 2 to 1, or $3\frac{1}{2}$ in all mash for 6 to 18 weeks The extra growth and protective factors of milk powder make this a sound policy with the pullets—also necessary to use greenfeed in addition *or* include lucerne meal Include at least 3 lb of milk powder in a breeders' mash with bran and pollard fed with grain 50-50 as the main ingredients, and 5 lb when crushed grains are used in a mash fed with grain 50-50 Halve these quantities for all mash—i e $1\frac{1}{2}$ lb and $2\frac{1}{2}$ lb per 100 lb (Refer to Chapter 18 for feeding milk powder to "grillers") Also check comments for addition of extra synthetic riboflavin (B_2).

Calculating Riboflavin Content

The following illustration is given (based on the table and information given in *Scientific Poultry Feeding* by G L McClymont and M W McDonald)

Example of High-energy All Mash for Pullets

(GIVEN AS RATION NO 3 FOR 6 TO 18 WEEKS FOR PULLETS IN THIS CHAPTER)

The riboflavin content is worked out as for protein, energy, or manganese The levels used in the various feeds are given as parts per million (p p m) in the chart, Composition of Feeds, in this chapter (pages 344-5)

Ingredient		*Riboflavin content in p p m*		*Total in feed*
59 lb crushed wheat	x	1 p p m	=	59
10 lb crushed barley	x	1 p p m	=	10
10 lb crushed oats	x	1 p p m	=	10
14 lb. meatmeal	x	5 p p m	=	70
$3\frac{1}{2}$ lb milk powder	x	20 p p m	=	70
3 lb lucerne meal	x	15 p p m	=	45
+ (salt, manganese, and oil—nil)				
100 lb				264

Therefore average per lb. = 2 64 p p m

The minimum needs are 2 p p m for this stage, hence the ration contains more than sufficient, even with grains

LIQUID SKIM MILK IN LIEU OF MILK POWDER

Skim milk is a valuable feedstuff for poultry, and when available on the farm should be utilized Pullets reared with this, combined with plain rations only, plus ample greenfeed, have matured very satisfactorily For information on its use see pp 283, 318 and 343.

COMPOSITION OF A MASH, AND EFFECT OF MINERALS

Very efficient results are obtained with crushed grains General work indicates that a mixture of grains in a ration is desirable for best results in growth and laying The main deficiency with grains is a shortage of manganese when the level of bran and pollard used in a mash is reduced below 50 to 60 per cent (The reduction in riboflavin and protein level when this occurs has been referred to previously) This applies in particular for manganese with the use of barley or maize Refer to chart for levels

The requirements of poultry for manganese are high, and particularly so for heavy breeds and breeding hens, whether for egg or meat strains and breeds

A small percentage of rice pollard rated at 280 parts per million would maintain an adequate level in a grain all mash (10 to 15 per cent would suffice) The normal manner of overcoming the deficiency is by the addition of a small quantity of manganese sulphate * The ordinary commercial manganese sulphate (dark in colour) can be used—it is approximately 70 per cent pure, but the nearly pure product—a fine powder off-white to pink in colour—costs a little more but is recommended, particularly for chickens, and is easier to handle and mix The simplest way to use it is to add ¼ to ½ oz manganese sulphate to the salt used per 100 lb feed The manganese and salt are used in the mash in the ordinary way as ¼ to ½ per cent of the manganesed salt in the ration per 100 lb of feed (When bore water of reasonable salinity is used as drinking water for the birds, salt would not be included) The cost of manganese addition is very low—usually under one cent per 100 lb of feed It is good practice to add manganese sulphate at all times even when bran and pollard form a good percentage of the feed

Proprietary lines are available containing manganese sulphate together with other trace elements Some products also contain A and D_3 (plus other vitamins) in powder form in combination with these elements Deficiencies of minerals other than manganese or calcium do not usually occur with good rations (The levels for manganese inclusion are given in the rations on pp 310-11) When sufficient meatmeal of suitable quality is included in the mash, phosphorus requirements are covered—it is necessary that some of this be from meatmeal Ten per cent of 50 per cent protein meatmeal would give sufficient calcium (1 per cent) and phosphorus (6 per cent) in a chicken all mash, but if replaced by 8 lb of 60 per cent protein meal, then approximately 2 lb of bonemeal would be necessary to maintain levels A low calcium level affects vitamin D_3 requirements also—rickets can be caused by incorrect levels of calcium and phosphorus as well as insufficient D_3 A low protein meatmeal, for example 40 per cent with excessive bone and hence calcium, can also cause trouble with reduced growth or perosis in chickens (Salt† at rate of ½ per cent in the total feed supplies sufficient sodium and chlorine ‡) Adult stock need a high calcium level (2 5 per cent)—and 8 per cent phosphorus level

* For reference—manganese sulphate may be referred to by symbol $MnSO_4$

† For reference—Salt may be referred to by the symbol NaCl

‡ For reference—Chlorine may be referred to by the symbol Cl

(*b*) for breeders—¾ oz. would add over 11,000 for 200 lb. = 55 p.p.m., giving a total of 83 p.p.m., which is more than ample (when wheat used).

(The rations listed on pp. 310-11 include ⅜ oz. per 100 lb. which adds 55 p.p.m., and ½ oz. per 100 lb. which adds 72 p.p.m. per lb.)

These examples show the need to adjust for this supplement, particularly with crushed grain rations. Deficiency of this causes poor shell quality, lowered egg production, and poor hatchability of eggs from breeders.

For reference on levels of manganese in various feedstuffs check the table on Composition of Feeds earlier in this chapter (pages 344-5).

A LACK OF ANIMAL PROTEIN

A shortage of animal protein in the mash will cause poor growth in young stock, poor feathering, and reduced laying and health with adult stock. Vegetable protein cannot supply all necessary elements. The level of meatmeal should not fall below 3 per cent in the mash when other forms of vegetable protein are available to balance the mash for protein. If at this level, some bonemeal would be needed to adjust the phosphorus level.

Good-quality meatmeal is usually dark brown in colour. A poor-quality meatmeal is pale in colour and contains a high percentage of bone. (Some other sources of anima proltein are milk powders, livermeal, some fish-meals and deep litter.)

The above covers the main deficiencies with poultry rations. The use of normal ingredients, as shown in the various rations illustrated, prevents nutritional deficiencies with chickens or adult stock.

References. H. W. McNary, former Director of Poultry Husbandry, University of Sydney, at the 1961 Poultry Nutrition School Sydney, presented a paper on "Genetics and Nutrition". This is a very valuable reference in which he indicated that Vitamin A, Vitamin D_3, riboflavin, and manganese requirements vary within breeds and strains, and that genetics may explain why a feed gives good results with most flocks, but fails in an isolated case or two. (It is expected that the levels in the feeds given here are sufficient, but problems may happen as above.) Professor F. B. Hutt of Cornell, U.S.A., in *Nutrition Reviews*, Vol. 19, No. 8, August 1961, indicated that a similar basis could apply for Vitamin B_1 (thiamine), amino acids and Vitamin E, and indicates that breeders should use feeds with normal levels of vitamins, etc., to practice selection so that biologically unfit individuals with abnormal requirements do not handicap future generations. (See also reference p. 79.) These references apply to both egg and meat production lines of stock.

THE FEED SHED AND EQUIPMENT*

The chapter would not be complete without dealing with the shed and utensils to handle the feed. Some suggestions are given here as a basis upon which to operate *if* a feed shed is used on a plant.

* When suitable prepared rations are purchased, which include all necessary factors including lucerne meal, a plant can operate without a feed shed. Silos at convenient points, or bins at the end of each shed or line of sheds, are filled from the delivery truck (by auger or blower). Supply is then taken from these

(*b*) for breeders—$\frac{3}{4}$ oz would add over 11,000 for 200 lb = 55 p p m, giving a total of 83 p p m, which is more than ample (when wheat used)

(The rations listed on pp 310 11 include $\frac{3}{4}$ oz per 100 lb which adds 55 p p m, and $\frac{1}{2}$ oz per 100 lb which adds 72 p p m per lb)

These examples show the need to adjust for this supplement, particularly with crushed grain rations Deficiency of this causes poor shell quality, lowered egg production, and poor hatchability of eggs from breeders

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(a) Four 44 gallon drums will hold a month's supply of wheat per 250 layers ($4\frac{1}{2}$ to 5 bags)

(b) Six 44 gallon drums will hold a month's supply of bran and pollard per 250 layers (3 to 4 bags of each)

(c) One 44 gallon drum will hold two months' supply of meatmeal per 250 layers ($1\frac{1}{2}$ bags)

(d) Four 44 gallon drums will hold two weeks' supply of all mash for 250 layers

Adjustments can easily be worked out for other grains or feedstuffs by referring to the sample rations described for the variation in space required

(4) A floor of solid type is advisable to prevent dust nuisance from the point of view of the operator—also to save feed and greenfeed spilt on the floor

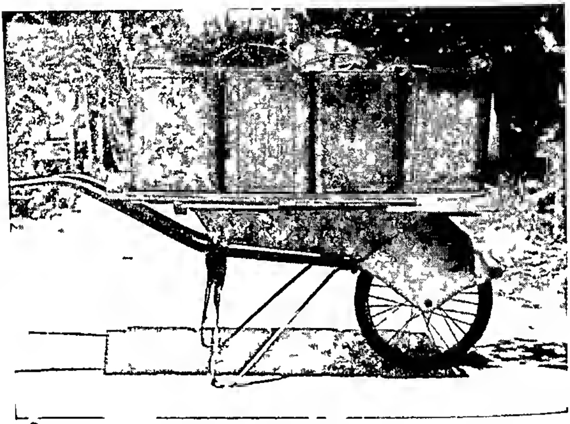


Fig 130 Wheelbarrow adapted with a covering tray and pneumatic tyred wheel to carry 8 buckets of feed This can make the movement of feed easier on the sideline unit

EQUIPMENT FOR A COMMERCIAL FARM FEED SHED

A commercial farm mixing feed needs a shed for the specific purpose of handling and storing feed with mechanical equipment power driven The size of the shed will be governed largely by whether bins for feed are built inside the shed, or silos are erected alongside the shed to hold grain and mill offals or prepared feed The area of the shed for a 2000-bird plant—

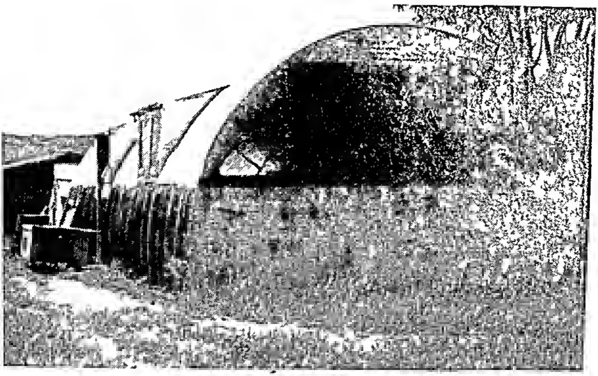


Fig 131 Nissen hut used as a feed shed A transport cart is shown A feed shed does not need to conform to set measurements, provided sufficient area is available for necessary machinery and/or for storage space

apart from the storage or bin area—would need to be at least 20 feet long by 15 feet wide floor area, and a convenient height would be 7 feet 6 inches at sides and 12 feet 6 inches at middle—gable roof construction See Fig 132 for the way this shed would allow the spacing of

(1) Motor (or motors) for driving machinery—electric or other power
(2) Power chaff cutter
(3) Grain crusher or hammer mill (with elevator or blower)
(4) Mash mixer (whether for dry or wet mash)
(5) Area for runabout or handcart and mash buckets

Power-driven connections to various units to be made by a belt operating from overhead pulley system—or provide individual motors for each unit operated Shield all machinery carefully, particularly the chaff cutter The set up can be varied to suit a different-sized building The same size shed could, provided the individual units were large enough, handle up to 5000 birds When purchasing a motor, see that it is big enough for the job you want it to do—the cost does not rise in proportion and it is there if needed to work a larger crusher or mixer

Note To mix wet mash for 2000 birds daily would require a 400 lb mixer (or approximately 12 to 18 cub ft) and 5 mixes would mix all mash for 2000 birds for one week (Capacity varies with energy level)

FEED STORAGE

Silos

An alternative would be the use of outside silos with a small chute with slide leading in to the area marked 5 in the first diagram These are available from proprietary sources and can be filled by auger or blower system

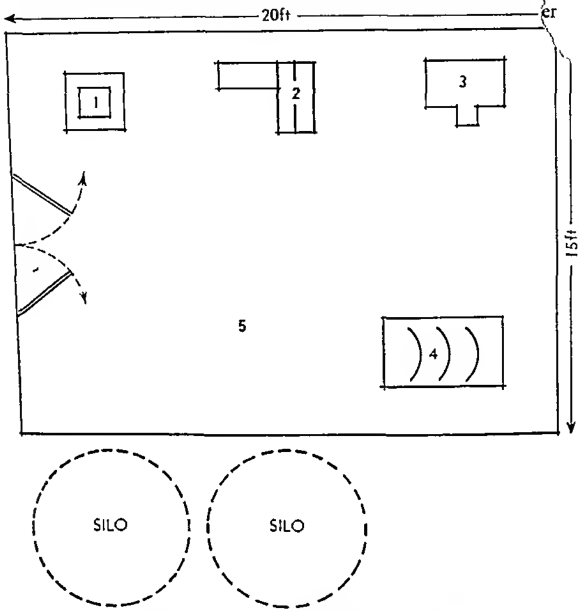


Fig 132. Layout of a feed shed with silos alongside.

For example, a silo 6 feet in diameter and 21 feet high against the end or side of shed would hold over 150 bags of wheat. Corresponding size silos would hold approximately 9 tons of pollard, or 5 tons of bran, or 13 tons meatmeal, or 8-10 tons of prepared all mash according to energy level.* These would save the extra shedding when comparing costs of silos with the shed and bins.

Bins

If it is desired to store inside the shed, then the shed could be extended by, say, 20 feet to provide bins as follows: (These can be varied in size as desired Galvanized-iron divisions will suffice)

1 wheat bin 20 feet by 6 feet by 5 feet high in front—filled from a window or chute would hold nearly 150 bags wheat—sufficient grain feed for 2000 birds for over four months

* This amount of prepared all mash would last 2000-2500 layers about one month. (As mentioned previously, with prepared feeds a silo could suffice instead of a shed)

1 pollard bin 9 feet by 4 feet by 5 feet high would hold nearly 3 tons
1 bran bin 10 feet by 5 feet by 5 feet high would hold nearly $2\frac{1}{2}$ tons, and
1 crushed wheat bin 5 feet by 3 feet by 5 feet high would hold nearly $1\frac{1}{4}$ tons (If crushed grain used only instead of bran and pollard, then the total capacity of these three bins 5 feet high would be approximately 8 tons crushed grain)

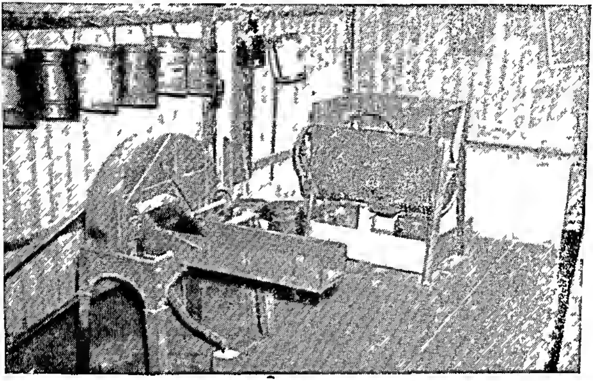


Fig 133 Inside of a feed shed for a commercial unit A power-driven mixer permits easy and efficient mixing of wet or dry mashes, and the oil drum buckets are convenient for general usage The power-driven chaff-cutter (with a suitable cover) is needed on a large commercial plant handling greenfeed The concrete floor makes for a clean feed shed

These would supply mash ingredients for 2000 birds for nearly two months exclusive of grain feed All four bins would supply total feed for about $2\frac{1}{2}$-3 months for 2000 layers An additional bin 5 feet by 3 feet by 5 feet high would hold $1\frac{1}{2}$ tons meatmeal, sufficient for $2\frac{1}{2}$ to 3 months' supply. Bins of this type could be arranged in the 20-foot extension as shown in Fig 132 The divisions against the passage need small doors or slides for entry when bins are low and small chutes to use when they are full They can be filled from windows above the bins from the outside of shed direct from a truck (*See also Appendix 6*)

SUMMARY

1. Study the feeding rations for all ages as set out in the opening of the chapter to assess background for the approach to economical feeding

2. Weigh up the points for the various systems of feeding Maintain economy in feeding Check on how to balance the protein and energy in

particular and other factors in a ration so that purchase of feedstuffs will be on the most economical basis

3 Assess the pros and cons of prepared mash purchase against mixing the feed on the farm This will be on the basis of availability of feedstuffs for rations, the comparative costs of buying in large or small quantities, and the value of labour and plant for mixing on the sideline or commercial farm

4 Carefully check on the feed efficiency level data for egg production, particularly the use of high energy all mash as a means of lowest production cost for feed and the minimum of labour with feeding, e g check labour cost for wet v dry feed systems (1-4 under Part I, pp 278-300)

5 Use of the proven mashes shown for chickens and layers will give good results Use of greenfeed in wet or dry form is stressed Carefully study feed reference chart pp 310-11, and concentrate mixture approach pp 315-16

6 Check feeding rations with the ready-reckoner methods given, and feed stock according to production and size of bird for efficiency

7 The adjustment of mashes for crushed grain and bran and pollard levels should be checked to maintain correct energy and protein levels in the rations in relation to ingredient prices (5-7 under Part II, pp 300-328)

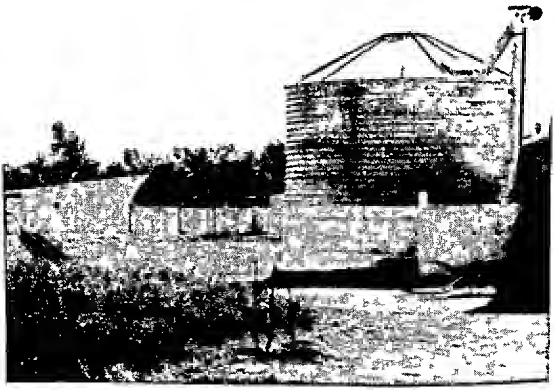


Fig 134. Large silo with auger system for filling with grain Silos are a sound investment, allowing a possible marked saving in costs by the purchase of alternate or coarse grains at harvest time, and efficient storage to save loss of quality or losses owing to vermin, weather, etc Other aids are a hand cart for greenfeed, stock-moving, etc, and the lucerne plot near the silo and feed shed

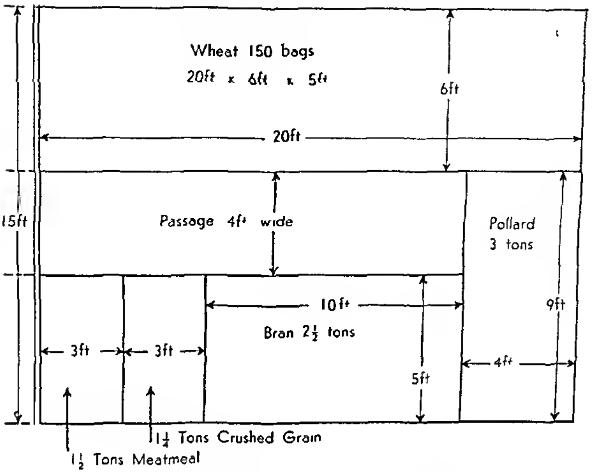


Fig 135 Layout for storage of feedstuffs

8 Check the question of feed supplements, and feed sidelights on extras necessary, also, how to handle the mixing of mashes

9 Use substitutes, particularly alternate grains and protein substitutes where it is economic to do so on the basis given This can be a major factor in reduction of feed costs, and can also indicate valuable leads, particularly in Asian countries, on use of economic by-products (8-9 under Part III, pp 328-43)

10 Check for the effect of deficiencies in poultry feeding, and prevent these troubles by the use of suitable feeds at correct levels

11 Feed shed equipment suggestions are covered Check on the storage question as a means of saving, and the recommended use of silos or bins (10-11 under Part IV, pp 343 61)

Note The crux of the whole question of economical and efficient feeding is a correct balance of the various ingredients—primarily for the relationship of protein and energy, and cost on this basis The rations given can be used with confidence With their use good growth and egg production can be expected from stock with a sound breeding background, suitably reared and housed The question of labour and investment costs can decide whether these feeds be mixed wet or dry on the farm, or prepared feeds based on these be purchased Future developments may indicate the addition of further economic supplements to these basic rations

Note Refer also to Appendixes 1, 6, and 8

CHAPTER 15

GREENFEED

THE provision of a sufficient supply of greenfeed is an important efficiency factor on a poultry-farm Well-known authorities overseas as well as in Australia emphasize the importance of the provision of good-quality greenfeed (in wet or dry form) for poultry for efficiency in feeding and health

The benefits are many, and include a saving in feed, maintenance of a high level of health and of production in the flock, together with eggs being laid that are attractive to consumers The need for it arises very soon after chickens are hatched Young stock need the essential factors that are contained in greenfeed To obtain the greatest benefit from it young succulent greenfeed (before it has flowered) should be used. Fibrous, stalky, dry greenfeed has only a limited value for poultry Greenfeed (containing carotene) is the normal supply of vitamin A for poultry, and must be given —in wet or dry form Good-quality greenfeed also supplies vitamin K, vitamin E, protein, carbohydrates, and is particularly rich in riboflavin (vitamin B_2) and also contains xanthophyll as the colouring agent (to provide golden yolk colour) plus necessary minerals and acids, and other unknown nutritive growth and tonic factors as yet not fully defined

Veterinary (and nutritional) authorities are agreed that one of the soundest methods of preventing nutritional and respiratory diseases and many deficiencies in diets, is the provision of sufficient quantities of good-quality greenfeed (T G Hungerford *Diseases of Poultry*, Agricultural and Livestock Series)

The importance of these factors must be stressed because the quality of the natural protein, vitamins, acids, minerals, and trace elements is such that they cannot be entirely replaced by synthetic substitutes A substitute, used when greenfeed is unavailable and containing Vitamin A only, *must* be used in conjunction with dehydrated or sun-cured lucerne, clover, or grass meal and this will then maintain a satisfactory ration for poultry

Many substitutes replace one specific factor—vitamin A—only When this is fed what happens? Layers do not develop nutritional roup as would be the case if vitamin A was omitted, but the eggs have light insipid yolks that are unattractive for sale as compared with deep golden yolk colour Also eggs do not hold well in storage when synthetics only are fed

Lack of regular supply is also a cause of unthrifty stock, mortality, and poor economic returns This is also shown by the normal flow of eggs from many sideline farms The bulk of eggs from them reach market when good natural grasses are available (good pasture is good-quality greenfeed) combined with the warmer weather As the natural grasses die off so does the supply of eggs, except where irrigated supplies of greenfeed are

available (or a substitute is used to counteract this tendency) Various points will be dealt with covering economic factors labour involved suitable crops, and suitable methods of dealing with situations where the supply of fresh greenfeed is not possible (The advance in specialization in poultry practices has entered greenfeed production also It is now possible for economic purchase of high quality greenfeed in dry form, e g dehydrated lucerne meal purchase enables greenfeed benefits to be obtained without small scale home production Alternatively, sun cured lucerne meal can be made on the property—dealing with greenfeed monthly instead of as a daily operation Costs of purchase can be assessed against home production costs and labour factor Further reference is made later in the chapter)

Note It has been found that many efficient farms conducting profitable operations over a long number of years have had a sufficient area devoted to the growing of greenfeed to provide sufficient quantities at all times These efficient men regarded it as a sound insurance policy against sickness in stock and fluctuations due to periodical setbacks because of low prices of eggs and high feed costs This provision is an old practice in poultry farming, but it is still an efficient operation Greenfeed as with some other food ingredients, is far more valuable than an analysis of known factors would indicate It can be used in wet or dry form

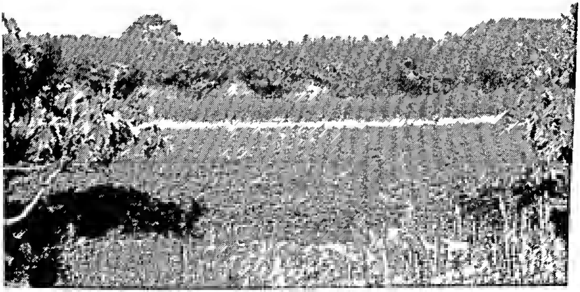


Fig 136 A block of lucerne enabling feed costs to be kept to a minimum Can be fed in wet form or cut, dried as hay and then hammer milled to feed as lucerne meal in dry feed Alternatively it is suitable for use in dry feed if the hay is chaffed finely Lucerne in foreground is young succulent and of high value

SUFFICIENT GREENFEED SAVES 15 PER CENT OR MORE IN COST OF FEEDING

A factor vital to all poultry farmers is that of feeding costs Any possibility of savings on this major item on the costs side of poultry farming should be exploited to the full

Food consumption when greenfeed is not included and low-energy feeds are used may reach 6 ounces per day of total feed This is influenced also by bird size, and the energy level of the feed The feeding rate should not be much over a figure of 90-100 lb of feed (4-4½ oz per day) per year with sufficient greenfeed and a sound ration For general purposes, based on commercial practice a figure of around 15 to 20 per cent saving in feed is thus shown with greenfeed used This involves a matter of only ½-¾ ounce per bird per day but this is 12 to 18 lb of feed per bird per year or approximately 3 4½ lb of feed per 100 birds daily With feedstuffs (involving both the protein rich meals and grain portions) at 3c per lb this represents 35c, to 50c per bird per year, or approximately $7 to $9 50 per week per 1000 birds less cost of small level Vitamin A as "insurance policy" even with greenfeed—approximately 75c per week per 1000

Alternative Greenfeed in dry form as lucerne meal, plus vitamin A substitute, can be efficient, and give comparable results with feed saving, egg yolk colour etc as with wet greenfeed Further reference is made later When lucerne meal is 2c per lb ($50 per ton) then 5 lb to 7½ lb or up to 10 lb with each 100 lb feed is the amount per layer per year and will cost 12c to 25c (The higher level can be used when lucerne meal is cheap compared with grains It would only reduce energy level to a small extent, and gives a deeper egg yolk colour)

Vitamin A substitute is necessary also, and if costing $6 per gallon for 5000 A per gramme product then the full level of 2 oz used (or equivalent powder level) in each 100 lb feed, or per bird per year, would cost 8c (With high quality lucerne meal, such as a dehydrated product, less would be needed) This gives a total cost of 20c to 32c per year Costs can be calculated for higher or lower prices for lucerne meal and powder or oil form vitamin A substitute The cost of 20c to 32c represents $4 to $6 50 per week per 1000 layers This cost can be assessed against the figures given above for wet greenfeed, and also gives a basis for greenfeed costs The labour factor of production and daily distribution with the wet greenfeed can be checked against the purchased cost of lucerne meal to be included in the dry feed mixture This aspect is discussed further

Note The level of greenfeed given need not be carried too far, an average quantity is 4 gallons or 8 to 9 lb of greenfeed per 100 birds daily The dry matter in good quality greenfeed is only about 25-33 per cent, which makes the above approximately 2-3 lb per 100 birds daily, but its value and use have permitted reduction of feeding quantities exceeding the analytical basis of its contents, based on field results—apart from its other needed properties in feed formulation

LABOUR FACTOR WITH GREENFEED

The main controversy on many farms concerning the question of the use of wet greenfeed is on the score of the labour involved The operations of ploughing, fertilizing, watering, seed costs, cutting, chaffing, and distribution of greenfeed are labour factors with the production of greenfeed

The figures have been submitted as to costs with the use of greenfeed

in natural form This is an amount that can be saved on the far
other feed-ingredient costs are beyond the control of the poultryı
small areas, but from a quarter-acre of reasonable land it s)c
with irrigation, to provide the greenfeed requirements of 1C00
The average efficient poultryman will endeavour to arrange his
work to reduce labour as much as possible, so let us do the sar
with the greenfeed question

ESTABLISHING AND HANDLING GREENFEED

Planting First let us consider suitable crops which will require the minimum of labour Some confusion may have been caused by a long list of greenfeeds available for poultry and also the question of frequent plantings of crops Where lucerne is used as the summer crop it means that once a stand is established it can be used for several years (six or seven years at least before replanting is required under good conditions) The necessity of planting only once in this period means, for a small operator, that arrangements can usually be made for the ploughing and working of the area—if the farm is large then it could be economic to have a rotary hoe or some other mechanical means of cultivation (A poultry-farm would have to be a very large one to warrant tractor installation) The question of the winter crop can be covered by the establishment of a stand of rye grass and clover—or clover and grasses that will give continual cutting throughout the winter (More information is given later about various clovers and crops) This indicates that it is quite sound to have only two crops to consider for the full year s supply of greenfeed Alternatively a solution is found with a very large lawn area of suitable grasses to meet all requirements, and provide pleasing farm surroundings Your State Department of Agriculture, Agronomy Branch, can advise the most suitable types of lucerne, clover, or lawn grasses for establishment

Concerning fertilizers where deep litter is available on the farm this is the most valuable fertilizer which can be used for the greenfeed area—retain sufficient for this purpose

IRRIGATION

The question of irrigation next arises This can be difficult if no water is laid on to the farm, and must be borne in mind when choice of location is being made (as referred to in the opening chapter) If water is laid on, then at 10c per 1000 gallons the normal drinking and irrigation requirements per 1000 birds could cost approximately 75c to $1 per week average over the year Adjustment can be made for higher costs per 1000 gallons Farms have operated successfully and supplied greenfeed requirements on this basis

If water is not laid on and a bore is necessary, then extra outlay which is difficult to assess will be required—but water would be required for drinking purposes with the poultry and one may be fortunate to obtain sufficient supplies for both purposes However, if a good supply is obtained the weekly or quarterly payment as with water laid on does not exist, and this

factor has often levelled out much more cheaply than the figure given above over a period Irrigation by sprinkler system, either a fixed pipe-line or the large rotating sprinklers available today from proprietary sources, permits easy watering of a large area Success has also been achieved by grading the area to be planted into several blocks and flooding the full block as required (For reference, 1 inch of water over an acre is equivalent to 23,000 gallons) This can be discussed with your State Department of Agriculture officers when dealing with the question of suitable crops for your area If water is available for drinking purposes only (in some cases this is possible from catchment supply) use greenfeed in dry form The laying shed roofs, with intensively housed birds having 4 square feet space, will catch sufficient drinking water in a 15 inch rainfall area

CUTTING GREENFEED

The crops mentioned have been suggested from the point of view of labour saving in cutting as well as planting operations There are a number of green crops quite suitable for poultry, but not with large numbers when it comes to the question of pulling leaves off plants It is necessary for efficiency to have a crop that it is possible to cut with a scythe—if handling only a moderate number of birds (500 to 1000)—or with a power cutter for large plants In this way it is possible to cut sufficient greenfeed for each 1000 birds in a few minutes—with a scythe or power cutter—and this is then picked up with a wide fork and placed on a transport vehicle such as a rubber-tyred handcart (a very handy item on the ordinary-sized unit) or on the large farm the utility or the power-driven runabout is used, for transport to the feed shed On many large units labour is reduced to the minimum with large lawn areas and a mower that chaffs the feed as it is cut from the lawn, or with power cutters that can cut, collect, and chaff lucerne with the one machine

CHAFFING THE GREENFEED

Provision of a full sized hand cutter for the smaller farm or a power-driven chaff cutter for the large farm possibly equipped with an elevator, makes it possible to cut greenfeed quickly A word in relation to the time of cutting may not be amiss at this juncture It can be a cold and often wet morning job cutting greenfeed During the winter months the practice on many efficient farms has been to cut the greenfeed the day before (three or four o'clock in the afternoon will do), and the greenfeed is in some cases chaffed immediately and then spread out over the floor, or is left stacked and then chaffed in the morning In hot weather when rising is easier, and conditions more pleasant, it can be cut in the morning However, results will be quite good if it is cut the day before, for any loss in value is slight (If greenfeed lost its value by overnight holding then no value would be left in lucerne meal or lucerne chaff, which remains out for 24 to 48 hours). This could also apply where large lawn areas are used for greenfeed and the cutting and chaffing are carried out in one operation

FEEDING OUT THE GREENFEED

The practice on some farms has been to incorporate the greenfeed with the morning mash where wet mash is fed The minimum requirements of poultry for daily consumption would be two gallons of good-quality chaffed greenfeed for 100 birds, and this can be incorporated in the mash

Where dry-mash or free-choice methods of feeding are used it would be necessary to feed out the greenfeed as a separate feed daily Also if wet mash is used with 2 gallons per 100 birds daily, it is desirable that an extra 2 gallons be given, unless combined with the addition of vitamin A in substitute form

RECEPTACLES FOR GREENFEED

Normal procedure when greenfeed is fed is to take the chaffed greenfeed out in buckets (on the handcart or vehicle) and tip this into the feeders used for the wet mash, or in feeders provided for the purpose These should be placed close to the door so that the minimum of time is taken to carry out this operation

Cases have been observed where quite efficient poultrymen have distributed greenfeed on top of the deep litter, and results have been satisfactory—with a saving in time spent on this operation However, it is suggested that less waste would occur with receptacles and also the question of the cleanliness of the greenfeed could be involved Where people have fed greenfeed to poultry such as kale, chou moellier, or silver beet leaves, which do not require chaffing, it has been handled efficiently by placing it in wire-netting "baskets" or "hoppers" These are made in the form of a trough set up so that the birds could pick from underneath (the bottom about one foot from the litter) and it provided occupation and supplied the greenfeed easily An adaptation of this can be made for chaffed greenfeed by using quarter-inch mesh so that the birds can pick from underneath, or the side and the greenfeed will not fall through too quickly

If the trough is made so that the bottom is 12 inches from the litter and the sides are 6 to 7 inches in height, this should suffice The opening at the top of the trough can have a rail (which will spin freely to prevent birds roosting on same), leaving a gap for feeding but preventing the birds getting into the trough A landing rail at the side is necessary level with the bottom of the trough for "top" feeding as well as underneath

When the type of outside feeding system such as guttering—described for the small-pen units—is used it is easy to feed the greenfeed quickly along the front of the shed without entering the pens at all, and each 1000 birds can be fed from a handcart or vehicle in five or ten minutes

The case for labour involved has been set out When crops requiring planting only every few years are used, irrigation is arranged properly, and cutting and distribution are handled in the manner described the labour of greenfeed growing and feeding out is constant but not heavy. Alternatively the use of large lawn areas can be efficient with low labour usage This work is balanced for cost against the savings on feed costs quoted before, and the purchase of greenfeed in dry form

ANALYSIS OF GREENFEEDS

On dry matter basis, 1 lb. dry matter = 3-4 lb greenfeed. Reference: G. L. McClymont and M. W. McDonald "Scientific Poultry Feeding".

	Crude protein %	*Food unit value* %	*Crude fibre* %	*Calcium* %	*Phosphorus* %	*Manganese parts per million*	*Riboflavin parts per million*
Lucerne before flowering ..	20	25	22	1.5	0.3	35	18
Lucerne after flowering ..	16	20	30	1.2	0.2	25	15
Lucerne meal	16	25	25	1.4	0.2	30	15
Lucerne leaf meal . ..	20	30	16	1.9	0.24	30	20
Clovers	15	22	25	1.1	0.2	35	15
Oats, barley, wheat (before flowering)	15	25	22	1.0	0.5	30	18
Oats, barley, wheat (after flowering)	10	20	30	0.5	0.3	25	8

Fig 137 Lucerne that has lost some of its value by being left too long before cutting This would not be suitable for young chickens, but could be used on adult stock Lucerne (and other crops) have their highest value just before flowering If supply gets ahead of requirements, the surplus should be converted to lucerne meal or chaff

AREA NEEDED FOR PLANTING

The minimum area to provide for the requirements of 1000 birds would be a quarter of an acre of good land irrigated and heavily manured Deep-litter manure is suitable for the purpose and superphosphate can be used in rotation with this

Some growers of lucerne topdress the block after every second cut as well as applying a dressing during the winter The quantities of lucerne that have been taken by some poultry-farmers from one-quarter acre have been a daily quantity of approximately 48 gallons (96 to 100 lb) over a period of nearly eight months of the year, which amount would supply the minimum requirements of 2000 birds daily during this time This is on the basis of taking a cut every four weeks, which is quite easy of attainment in warm weather This represents approximately five tons per acre per month (Lucerne likes warm weather—and warm nights—for quick growth) During the hot-weather period, and with sufficient watering, the supply may get ahead of requirements and it is a wise plan to convert the balance to lucerne chaff or meal (more is said on this practice later in this chapter)

From the above it can be seen that one-quarter acre can just meet requirements, as the balance of land is available for winter requirements, which are not as high (A supplement can be used with advantage, this being covered later) If possible a larger area can be planted—the extra greenfeed can be used or stored as chaff, meal or silage The level of green-

feed given can be much higher in the summer months than in the winter—it is also more palatable in hot weather

INCREASING THE PALATABILITY OF GREENFEED

A practice that has been used by a number of poultrymen has been to feed a "salad" at midday when the quality of the greenfeed was not as high as desirable, but it is better to try and produce good quality green feed This is done by mixing a little wet mash with the greenfeed (about 3 parts greenfeed to 1 part mash) to make it palatable It is necessary to add a Vitamin A supplement with this Synthetic Vitamin A should be added as a normal practice but particularly during the winter mooths and when the quality of the greenfeed is poor

DAILY QUANTITY PER 100 BIRDS

Greenfeed requirements for 100 birds under normal circumstances have been met by the provision of $4\frac{1}{2}$ lb of high quality greenfeed daily ($\frac{3}{4}$ oz per bird) but a higher level of 7 to 9 lb daily should be given if available

Weight of greenfeed is rather difficult to assess, because from very dry to very wet a 4-gallon bucket will vary from approximately 6 lb to 14 lb A possible average figure is 9 lb for a 4 gallon bucket and this quantity would be sufficient and ample for 100 birds ($1\frac{1}{2}$ oz per bird daily) Only half this amount (the minimum requirement)—that is, 2 gallons daily per 100 birds—can be incorporated in a morning wet mash—the balance can be given as an extra feed during the day, otherwise combine with a supplement (On dry weight basis, these quantities represent $\frac{1}{4}$ oz to $\frac{1}{2}$ oz per bird daily)

TIME OF DAY FOR GIVING GREENFEED

There is no set time at which greenfeed need be given to the birds As referred to above, up to 50 per cent of the day's supply can be given in a morning wet mash The practice on some farms has been to feed the balance at midday and then grain in the evening There is no hard and fast rule to say that this should be so Experiments carried out in Victoria many years ago showed that extra greenfeed after grain at night was also quite satisfactory The beneficial effects of a run out on grass at night have been proved by many hundreds of sideline producers—in most cases this has been the sole greenfeed supply for the day and results have been good (In dry form it is included in the ration, and consumed over the full day)

The above indicates that greenfeed does not have to be given at any particular time Whatever practice is adopted should be adhered to Birds will resent chopping and changing of times, as they will look for their feed at the time to which they have become accustomed

SEASONAL VALUE OF GREENFEED ADJUSTMENTS FOR VALUES AND QUANTITIES DURING SUMMER PERIOD

The vitamin A level in greenfeed is rated higher in the summer period, also the intake is usually higher with the birds Vitamin A needs could be

met without supplements with young succulent greenfeed If greenfeed is of normal or poor quality (for example cabbage leaves or coarse grasses are poor quality as compared with high-quality greenfeed such as young lucerne) then the addition of some oil or powder containing vitamin A is necessary In this case a minimum quantity of oil 5000A potency per gramme should be added to the feed at the rate of ¼ oz (½ tablespoonful) daily per 100 birds or if more convenient it will be quite all right to give ¾ oz every three days in the water With dry feed this would mean the addition of 1 oz to each 100 lb of all mash as the correct quantity Use a high-quality oil emulsion When using powder of 10,000A level per gramme this would mean ½ oz This is preferable for use with dry mash

This can also be adjusted for oils of lower value, for example 2500A rating per gramme would be added at the rate of ½ oz (1 tablespoonful) daily for 100 birds or 4 oz in 100 lb of dry mash with equal quantity of grain (Half in all mash)

DURING WINTER PERIOD—ALWAYS USE A VITAMIN SUPPLEMENT

During the winter period the greenfeed supplied would not have the same level of vitamin A, also the consumption of greenfeed by birds is less For this reason it is strongly recommended that powder or oil should be added at the rate advised above, that is ¼ oz daily per 100 birds of a 5000A per gramme rating oil emulsion or the addition of 1 oz of this oil to each 100 lb of all mash The maintenance of adequate vitamin A intake during the winter months by combination of the greenfeed and the half level of the substitute is very helpful to health as a safeguard against vitamin A deficiency, colds, and general respiratory troubles, also to sustain egg laying and growth

Note Laying results in official tests and on commercial farms have shown the efficiency of this practice of combining some vitamin A oil or powder with the greenfeed under these circumstances, and its adoption is strongly recommended

GREENFEED QUALITY

As a yardstick for assessing quality or value of greenfeed (apart from the need for it being used when young and before flowering) the darker the greenfeed the more valuable it is, for example, lucerne, clovers, spinach, half-grown oat and wheat crops are richer in vitamin A than mature maize or cabbage, which are light-coloured greens The condition of the soil is also a factor in this respect Reference should be made to your State Department of Agriculture for soil features in your locality

VITAMIN A SUBSTITUTES FOR GREENFEED

In a number of cases greenfeed is not made available to poultry, owing to lack of area for planting greenfeed, lack of irrigation facilities to cope with the dry period of the year, or because of the practice which has been adopted on a number of farms of reducing labour by using a substitute as a constant ingredient in the mash The effect upon the birds, egg quality,

and costs was discussed earlier in this chapter Normal substitutes used contain synthetic vitamin A Formerly cod-liver oil was used almost exclusively with reasonable results where good samples of oil were selected Under present-day conditions the use of stabilized synthetic powders or vitaminized oil emulsions of high potency with the vitamin A content stabilized to a much higher degree than in the former cod-liver oils, is the general practice

QUANTITY OF VITAMIN A POWDER OR OIL EMULSION TO BE USED

Laying Birds

A stabilized powder containing 10,000 units of vitamin A per gramme will have to be fed at the rate of ¼ oz daily per 100 birds to supply sufficient vitamin A to maintain full health and egg production This can be given every three or four days for convenience and the quantity adjusted accordingly, that is, ¾ to 1 oz for 100 birds on each occasion This applies for daily feeding systems With dry mash used the quantity required can be mixed weekly with the addition of 2½ oz of stabilized powder of this strength to each 100 lb of mash fed with grain One hundred pounds of mash would last approximately eight days for 100 birds where a mash was fed with grain If an all mash was in use then 1¼ oz would be needed per 100 lb * With oil emulsion vitamin A containing 5,000 units per gramme double the quantity would be needed—2½ oz per 100 lb all mash and if fed daily ½ oz per 100 birds If 2,500 units per gramme then 5 oz per 100 lb all mash is used

When breeders also are without greenfeed or lucerne meal and powder is being used it would be advisable to increase the quantity to 3½ oz in 100 lb of mash where powder of this strength is being used, or 1¾ oz in an all mash Increase oil emulsion in proportion, that is 3½ oz per 100 lb all mash (approximately ¾ oz (1½ tablespoonfuls) if fed daily per 100 breeders)

Chickens

Where chickens are being brooded in enclosed conditions (which applies to most brooders in the early stages and in the cool early months of the breeding season) vitamin A is added to the mash even if greenfeed is available Ample allowance should be made for any absorption factors in the feed, also chickens show symptoms of vitamin A deficiency much sooner than adults, hence it is suggested that a minimum level of 1 to 1¼ oz † of 10,000A per gramme powder per 100 lb of all mash be included in the ration (Vitamin D also has to be included but this is covered later)

Note The measurements quoted allow a safety margin and no deficiency will be experienced unless the feed is held for a long period Vitamin A in powder form covers feed for a long period It is suggested that with stabilized oils in mashes a week be regarded as a reasonable holding period, and not longer than a fortnight

* This level will maintain 3500 units of vitamin A per pound of feed

† This level will maintain a minimum of 2800 units of vitamin A per pound of feed

DISCUSSION ON VITAMIN A IN POWDER FORM

Vitamin A can be obtained in synthetic form as a stabilized powder of high potency and can be used to supply this vitamin The advantage of powder is the longer period that it will hold its potency as compared with oil Powder mixed in feed can be held for several weeks, but on this score the question of palatability and factor of staleness with the other ingredients should be considered It is regarded as more suitable than emulsion for feed manufacturers as it enables feeds to be sold on a more reliable basis as to vitamin content if held for a period Considerable care should be taken to premix this product carefully to ensure even distribution

Some proprietary sources market the powder so that it can be used on a farm Carefully mix by "spreading through' using the medium of some pollard or the concentrates to make a "premix' to work it through the mash Where mash is mixed weekly oil emulsion is satisfactory and there would be no gain in using powder if the synthetic powder cost more, but powder is advised if feed is to be held longer than this

RIBOFLAVIN CONTENT OF GREENFEED AND NECESSITY

Greenfeed is an excellent source of natural riboflavin, having nearly as high a content as milk powder when in dry form This is one of the many factors that are so valuable in good greenfeed Where a substitute is used for the vitamin A it is necessary to add a substitute for riboflavin also These are obtainable in substitute form from proprietary sources

SUNSHINE FOR POULTRY AND VITAMIN D_3

This chapter is primarily devoted to greenfeed for poultry, but in order to clear some confusion that may exist in the minds of beginners, the question of the sunshine or vitamin D for poultry is discussed here This is done because if oil or powder is being purchased for poultry, it will be found that in most cases the oil or powder is quoted as containing vitamin A and D_3 It is highly desirable that this should be so as, although an oil can be obtained which contains only vitamin A, it is strongly advised that the product containing both vitamins be obtained This is suggested for the following reasons

1 The cost of vitamin D_3 is very little and the requirements of poultry are high in this direction—possibly much more so than is generally realized Even when sunshine is available to the birds on range in hot weather they may shelter in the shade for long periods, and in winter they have only limited hours of sunshine, hence it is doubtful if the desirable level is often attained The additional cost between vitamin A only purchased, and vitamin A plus D_3 in terms of popular products, is only about 2½c per day per 1000 layers

2 Poultry kept intensively cannot gain their full requirements from the limited sunshine that enters the front of the shed, and it should be regarded as essential to provide them with vitamin D_3 in the mash at all times of the year particularly for breeders Even though reasonable results in health and production may be obtained without this the maintenance of

good shell texture alone would be worth the small cost Also resistance to coryza or colds, and possibility of rickets even in a mild form, makes it an efficiency practice Tests have shown a marked increase in laying results with this low cost addition of vitamin D_3 to the ration throughout the year, with the greatest gain in rate of lay during the winter months (N S W trials showed 10 per cent gain in winter lay)

3 The requirements of chickens for vitamin D_3 are high Also if an oil containing vitamin A only is on the farm (and labels can be defaced on a tin or bottle) there is a danger (and it has occurred on sideline farms in particular, and also some commercial plants) that this is used to mix the chicken mash, and in a short time a first class case of rickets with heavy loss of chickens and potential loss of production is incurred This can be prevented at very low cost A minimum level of 400 units of vitamin D_3 per pound of feed used for chickens should be maintained to allow a safety margin

4 The use of products containing 5 parts A, 1 part D_3 ratio at levels given here for A will cover alt needs for D_3 adequately When a lower A level is used because of greenfeed or good quality lucerne meal in diet, products of 3 parts A, 1 part D_3 are available to maintain desired ratio

LUCERNE MEAL AND LUCERNE CHAFF IN LIEU OF GREENFEED

Well cured lucerne meal or lucerne chaff retains the many properties of greenfeed listed except that the level of vitamin A is lowered They cannot be held for very long periods—it would be inadvisable to rely on the level of vitamin A after six months Skill in curing the chaff is a big factor in its value—if left too long before chaffing it will be low in value Artificially dried or dehydrated lucerne meal is highly efficient and has a much higher level than that from sun or shed dried lucerne chaff (or hay) It is unwise to rely on this point, although with good curing and holding methods the other factors contained in greenfeed are usually retained to a high degree The recommendation is that powder or oil emulsion containing vitamin A should be fed in conjunction with lucerne meal and results nearly comparable with greenfeed can be obtained in relation to egg yolk colour, egg production, and health in the birds The vitamin A addition can be used with good lucerne meal products at a somewhat lower rate than when no lucerne meal is included (75 per cent of normal full level is minimum suggested) It is suggested that 3 to 4 per cent of lucerne chaff be regarded as the maximum for chickens, or 5-10 per cent in an all mash feed for adults when no greenfeed is given

ECONOMIC FACTOR WITH LUCERNE MEAL

The use of lucerne meal (or chaff) with vitamin A substitute is highly efficient, but the question of costs should be considered

Vitamin A cost has been discussed before If lucerne meal can be obtained at a cost not higher than crushed grain or mill offal then it does not

increase costs* to use it in the ration as 5 per cent of the total feed It saves protein also when a good-quality product When 17 to 20 per cent protein lucerne meal is used, 5 per cent level in all mash makes it possible to save 1 lb of meatmeal in 100 lb total feed—nearly 10 per cent The advance of specialization in its production particularly with dehydration, will be a big factor in reducing costs and the level of its use up to 10 per cent is decided by this If its cost per ton is equal to average of main ingredients then there is no cost increase when substituted for them on a pound for pound basis with the basic feed ration With a correctly balanced high energy ration very low feed usage per dozen eggs can be maintained (see p 313) There is a potential market for 50,000 tons of lucerne meal in the Australian poultry industry The general recommendation is that when greenfeed is not used, good-quality lucerne meal with vitamin A substitute will be very efficient It is very much more efficient than vitamin A only by enabling a complete ration to be prepared at no significant increase in cost, and maintaining production of healthy birds and good-quality eggs No ration fed without greenfeed can be regarded as complete unless lucerne meal plus substitute vitamin A is included in it—*and* sun-cured lucerne meal can be quite efficient

Note Other known vitamins such as vitamin E may be needed with sun-cured lucerne meal held long periods

HOW TO MAKE SUN-DRIED OR SHED-DRIED LUCERNE

Lucerne chaff or meal can be produced by sun- or shed-dried methods very easily on the farm (Large specialized plants would be needed to cope with dehydration Artificially dried lucerne meal may be available in some districts and localities—this is a specialization factor that can be expected to expand in the poultry industry)

The making of chaff on the farm is an effective move In any business an insurance policy is usually taken out against eventualities that may arise, and the making of lucerne chaff is precisely this When the change-over of season occurs there may be a period of shortage between crops or due to the inroads of lucerne flea a shortage is precipitated Other causes will sometimes result in shortages For these reasons it is best to have more area under lucerne than is regarded as strictly necessary to enable ample lucerne chaff (or meal) to be made as a reserve

HOW TO MAKE LUCERNE CHAFF ON THE FARM

Sun-dried Lucerne Chaff

Select a period when the supply of lucerne is well ahead of current needs and the weather appears to offer a possibility of a few days of fine conditions Cut the area available on the lucerne block either by scythe (if only

* When lucerne meal is costly, or quality is poor, additional use beyond the 5 per cent minimum level for nutritional purposes, may not be economic If markets pay a premium for deeper yolk colour than with this level (for example increase from No 5 to No 7 on the widely used Roche colour fan) it can then pay to add pigmenter, as available from proprietary sources to the ration A well run farm produces over 400 dozen eggs for each ton of laying feed used—an added cost of $1 50 per ton would require 4c per dozen to balance outlay

a small unit) or by power cutter or mower Allow the lucerne to lie for approximately 24 hours and then, with warm conditions, it should be ready for chaffing If conditions turn cool it may be necessary to leave it lying until the following day, but this must be watched very closely If it is left out too long the valuable portion of the chaff—the leaves—will fall and a very poor sample of chaff will be obtained with a high percentage of stems This is the ticklish part of preparing lucerne chaff—the hay should be brought in as soon as it seems dry enough—the earlier the better as regards quality of the lucerne chaff Take it in too green rather than too dry When carted in from the block the lucerne hay is chaffed and can then be spread outside (preferably on an impervious surface such as concrete or asphalt) Turn the chaff over for two days about four times daily and then it should be sufficiently cured for storage Another day may be necessary if the weather is cool Turning on the first day is important or the chaff may "burn" and spoil

Note. If the cutter will chaff the lucerne in $\frac{1}{8}$-$\frac{1}{4}$ inch lengths then it can be used in an all mash without being put in a hammer mill.

Storage of Lucerne Chaff

Store in bins (airtight if possible) or a dry room or shed, free from draughts, and do not let the sun shine on the chaff or it will bleach very quickly—the greater the evaporation and drying out the more quickly will the chaff lose its colour, quality, and value *

Note When using lucerne chaff some farmers feeding wet mash soak the chaff the night before by sprinkling or hosing the required quantity spread out on the floor This is not needed as dry chaff cut small can be used quite well in dry mash.

Shed-dried Lucerne Chaff

The procedure for drying on floor of shed is as described for sun-dried chaff up to the stage of spreading Then instead of spreading outside it is spread on the floor of a shed, preferably with an open aspect to the sun, although it has been successfully cured when careful attention to turning is used in a shed enclosed on all sides as it is normally carried out at the warm period of the year Turn at least twice daily for two days and then once daily for four or five days, when it should be ready for storage A broad fork with only about 1 inch to $1\frac{1}{2}$ inches between the tines is suitable for this work The time taken is usually twice that of the outdoor process under comparable weather conditions The floor of the shed should be concrete or a hard-type floor to facilitate this work.

SILAGE FOR POULTRY

"Surplus growth of cereal crops, lucerne, grasses or clovers can be ensiled in small pits or drums, the chaffed greenfeed being packed in tightly and weighted down The quality of lucerne and clover silage can be im-

* If a hammer mill is available on the farm, then the chaff (or hay) can be made into lucerne meal which can be handled more easily for storing, and used in the feeding ration.

proved by using molasses and water mixed in equal quantities and adding 20 per cent to the silage, for example 4 gallons molasses 4 gallons water for a 44-gallon drum of silage

"Silage may affect the quality of egg yolks" (G L McClymont, M W McDonald *Scientific Poultry Feeding*)

WHAT HAPPENS WHEN POULTRY ARE WITHOUT GREENFEED OR A SUBSTITUTE?

This is a question that may arise in the mind of a person after reading the foregoing discussion on greenfeed or substitutes for poultry

The effect on poultry when greenfeed is not available, or a substitute is not given to try and overcome the lack of greenfeed, is very serious and a very high percentage of mortality can occur—any fowl starved of vitamin A for long enough will die through vitamin A deficiency or "nutritional roup' The earliest symptoms are a falling off in condition, feathers lacking in lustre, retarded growth in young stock, and declining egg production with layers As the condition extends birds waste away and examination will show small white pimples in the mouth, at the base of the tongue, and in the throat The nasal cavities show a discharge and may become plugged with cheesy material At a later stage there is a water from the eye and a white material is found to be present in the eye A staggering gait in young chickens may be observed Hatchability of eggs is heavily reduced, and rearing losses among the chickens from the eggs which do hatch are heavy

To treat this, in addition to providing greenfeed or lucerne chaff or meal if possible, supply powder or vitaminized oil or cod liver oil Feed the powder or oil at two or three times the normal rate for two or three days and then continue at the normal rate This will correct the trouble rapidly Even sick looking birds can be saved Very sick birds can be treated individually (The normal rate of 5000A per gramme oil would be ½ oz (1 tablespoonful) daily for 100 birds, so 3 tablespoonfuls could be given daily for three days and then use the normal rate plus greenfeed or lucerne meal)

By way of preventive measures, provide the following at sufficient levels and avoid heavy mortality with chickens and stock, and economic loss with lowered egg production, which can occur with vitamin A deficiency or nutritional roup

(*a*) High-quality fresh greenfeed preferably plus half level powder or oil

(*b*) Lucerne meal or lucerne chaff plus powder or vitaminized oil or cod liver oil at sufficient level (approximately 75 per cent level)

(*c*) Powder form vitamin A supplements, vitaminized oil emulsion or cod liver oil at full level *

* Suggested—Chickens 2500 layers 3500 breeders 4500 units of vitamin A per pound of feed

SUITABLE CROPS FOR PROVIDING GREENFEED

How to provide greenfeed for poultry without frequent plantings is a big factor in saving labour This can be brought about by concentrating on a crop that can be cut a number of times during a season, is adaptable to the use of easy or mechanized cutting, can be easily irrigated, and has a high value as greenfeed for poultry This can be supplied by means of lucerne, clovers of various types, and lawns *

Some confusion and also the feeling that greenfeed supply seems to involve a lot of frequent planting may have been caused by grouping various crops for each month together A simple approach is made by suggesting two crops that, together with lawns, will meet requirements in most States

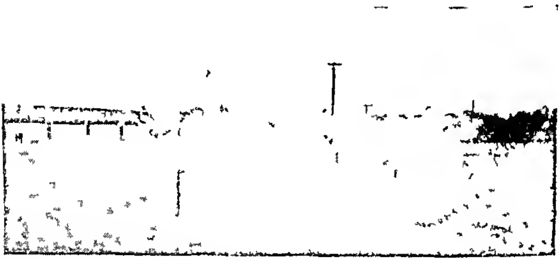


Fig 138 Large area of lucerne under spray irrigation, suitable for a large commercial plant Large areas make possible not only the provision of sufficient quantities of greenfeed for daily requirements, but also the making of lucerne meal or chaff

LUCERNE

The opinions of agricultural departmental officers and commercial poultrymen, and results with field work in all States, concur on the outstanding value of lucerne as the crop of unsurpassed value as a fodder for poultry, with its high protein level, adaptability to various areas and heavy productivity over a long period of the year Lucerne can be grown in a variety of soils and can be planted in autumn or spring It is hardy under drought conditions, but for poultry farming requirements where heavy cutting on a small area is the general rule, irrigation is necessary by overhead sprinklers or flooding The ground for lucerne needs to be well worked and fallowed to provide a weed free seed bed Seed can be sown in rows or broadcast Seeding rates up to sixteen pounds per acre can be used for planting for the small irrigated areas used for poultry Only the

* Some farmers have been successful with kikuyu lawns, and a lawn mixture given later Apply to your State Department for local recommendations

best available seed should be used. Deep-litter poultry manure is a valuable fertilizer for lucerne. (The minimum area per 1000 birds under favourable soil and irrigation facilities would be a quarter of an acre for all greenfeed crops or an eighth of an acre lucerne and an eighth of an acre other crops.)

Up to eight cuts can be expected during a season with lucerne under good conditions. Although essentially a summer crop, in some localities supply continues throughout the year. Cut before flowering for highest feed value. Stands are usually replanted after five to seven years, although many stands are used longer than this. Lucerne can be cut easily with scythe or mechanical cutters. Surplus lucerne should be made into lucerne meal or chaff as a reserve. For complete information on lucerne growing contact your State Department of Agriculture.

CLOVERS

Clovers can be established for winter greenfeed supply and the full year round with some suitable varieties and irrigation facilities. Clovers are very productive and can be made into clover meal. Use in same manner as lucerne meal. Check comparative cost as efficiency is slightly lower.

Fig. 139. Clover and rye grass mixture. Clovers are a very good greenfeed for poultry, particularly during the winter period when lucerne is dormant in many areas.

Berseem clover gives a succession of cuts of succulent greenfeed. It has to be resown each year. Clovers such as strawberry clover are becoming popular for high-rainfall districts or under irrigation and do not require replanting.

With irrigation this clover can be used throughout the year. Clovers are frequently sown with a mixture.

LAWNS

Where poultry farmers desire a winter crop with a summer lawn effect a suggested mixture is Palestine strawberry clover, Kentucky blue grass, and couch Lawns give very pleasing surroundings to a farm, and with a suitable power mower, cutting and chaffing in one operation saves labour Where a higher production of greenfeed is required (without lawn effect) the grasses mentioned above should be replaced by perennial rye grass short rotation rye grass, and cocksfoot

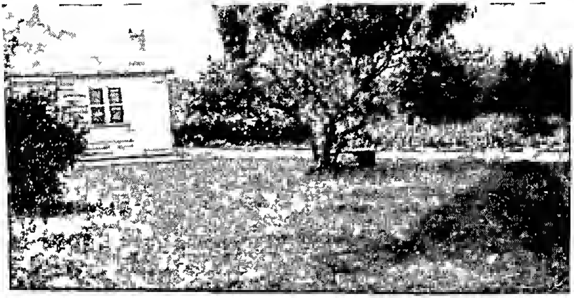


Fig 140 Extensive area of lawn around farmhouse This not only makes for pleasing surroundings, but gives a plentiful supply of good quality greenfeed Suitable power mowers cut, chaff, and collect in one operation thus saving labour

TABLE 14

GUIDE TO CROPS SUITABLE FOR PLANTING

GROUP A—should ensure continuity of supply of high quality greenfeed with high productivity without replanting for each cut and can be cut easily with mechanical cutters

Months to sow	*Crop*	*Period of estimated supply*
March to May September and October	Lucerne	September or October to May
March to May and September	Clovers (e g berseem, strawberry)	Berseem—March or April to September Strawberry—April to November, but with irrigation summer growth can be obtained i e 12 months' production
	Lawns	Check with your State Department of Agriculture for local recommendations

Note: For the best clover and lawn varieties suited to your soil and rainfall conditions, it is suggested, as for lucerne, that contact be made with your State Department of Agriculture. Also Russian comfrey has received publicity as a high-protein greenfeed for poultry It can give a high yield with heavy manuring and watering. For full information contact State Departments of Agriculture.

GROUP B—Crops that can be sown if suitable to the district. Mostly available eight to twelve weeks after planting.

Months to sow	
January ..	Maize, rape, cowpeas.
February ..	Maize, barley, rape, field peas, mustard, kale, silver beet.
March .	Wheat, oats, rape, barley, field peas, kale, silver beet, rye grass with clover, chinese cabbage.
April .. .	Mustard, phalaris, oats, barley, field peas, kale, red clover, sweet clover, chinese cabbage, rye grass with clover.
May	Clovers, oats, barley, silver beet, peas.
June	Barley.
July	Rye, barley.
August ..	Silver beet.
September	Maize, hungarian millet, rape.
October .	Cowpeas, maize, barley, hungarian millet, rape, silver beet.
November .	Cowpeas, maize, hungarian millet.
December .	Cowpeas, maize.

The above tables are partly from T. G. Hungerford's *Diseases of Poultry*, Table XII—Sowing of crops (with lucerne and berseem clover transferred to Table A) acknowledged therein as supplied by the New South Wales Department of Agriculture, and the balance from *Poultryman's Calendar for Growing Green Feed*, by W. C. Rugg, a former State Poultry Expert, Victoria. Reference re clovers A. J. K. Walker, Department of Agriculture, South Australia.

Rates of sowing suggested:

Berseem, clovers, millet	12 lb. per acre
Peas in mixtures	20 lb. per acre
Oats and barley	80 lb. per acre
Mustard	100 lb. per acre

(All recommendations for times and crop types are for Australia.)

VEGETABLE TOPS, AND USE OF GRASSES

Turnip tops, carrot tops, pea vines, bean vines, and possibly cabbage leaves can be used as greenfeed. Good grass can be cut for poultry and is good-quality greenfeed. Avoid obvious weeds. Marshmallow fed continuously over a long period will cause "pink" or "amber" whites in stored eggs and affects condition of the egg white. Other egg conditions such as "green yolks" are suspect as having been caused in some instances by feeding very sappy greenfeed in heavy quantities.

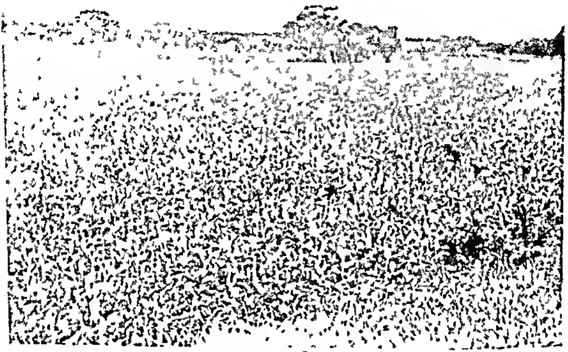


Fig. 141. Field peas. This is another of the numerous greenfeed crops that can be used for poultry.

This chapter emphasizes the importance of vitamin A (and D_3) for poultry in good-quality greenfeed (wet or dry), the supply of which is of considerable economic importance to the poultry industry.

SUMMARY

1. Good quality greenfeed is a vital factor in poultry feeding, because it supplies a number of essential requirements, including vitamins A, B_2, E and K, minerals, acids and various growth and tonic factors. It safeguards against nutritional and respiratory complaints, by maintaining a healthy condition in stock.

2. It is an insurance policy against high feeding costs. It can make possible a marked saving in feeding costs by 15 per cent or more. This can be a substantial item ranging up to $10 per week per 1000 layers with the examples given. It is a cost which can be saved *on the farm.*

3 The work of growing greenfeed can be planned, by the use of crops that do not need replanting to permit production and handling for a reasonable labour requirement, when combined with mechanical equipment for cutting and watering Planning should include planting at the right periods to maintain a continuity of supply Refer to the tables given

4 Lucerne has the highest all-round value as a greenfeed for poultry Clovers are also very valuable, and lawns can be a prolific source of green feed All these crops save the need for frequent replanting, and will need only the minimum of labour for cutting, chaffing and distribution to the birds

5 Lucerne meal is valuable for poultry of all ages and can give comparable results with greenfeed The quality of the meal is controlled by the curing methods used, and the period it is held It can show a very marked saving in labour used with daily greenfeed distribution It can be included at 10-20 per cent level in adult mashes fed with grain, 5-10 per cent in all mash and 3 to 4 per cent only in chicken mashes It does not increase the cost of the basic ration under normal conditions Dehydrated lucerne meal of high quality may not need vitamin A supplement

6 The addition of vitamin A (plus vitamin D_3) in substitute form with sun-dried lucerne chaff or when greenfeed quality is low is essential and must be added with all systems during the winter, and throughout the year with intensive systems It is desirable that a substitute be included in all rations at all times in view of the benefits and insurance against possible losses for the low cost involved

7 Regard the use of greenfeed in wet or dry form as an efficiency move as it assists a low usage of feed per dozen eggs produced It can be grown on a limited area, and is a factor within the control of the poultryman in reducing the quantity of feed required to produce a given number of eggs If circumstances of area, soil, watering facilities or labour make it impracticable to grow greenfeed, then it is vital that it be purchased and included as dehydrated or sun cured lucerne meal, plus vitamin A substitute This will preserve efficiency with health and production of good-quality eggs No ration without greenfeed available can be regarded as complete without this addition The advances of specialization in the industry have now made it possible to obtain high quality lucerne meal Purchase price can be assessed against home production investment, plus labour cost (Refer also to Appendix 1)

References suggested for further information on lucerne meal and its value for providing deep yolk colour 'Feeding for Yolk Colour', by P Smetana W A Dept Agriculture, indicates 3% dehydrated or 7% sun-cured lucerne meal advised for 6½ colour level on Roche fan Consumers prefer Deep Egg Yolk Colour', by B E Bartlett and M R Barlow, Vic Dept Agriculture, refers to survey indicating preference for very deep colour by consumers

CHAPTER 16

REQUIREMENTS FOR MARKETING OF EGGS

THE marketing of eggs is the final step in the process of egg production, and the care given at this stage is vital for maximum returns When the egg is laid it is usually a first-grade sterile product, but owing to the porous nature of the shell it will gradually deteriorate in quality, particularly in warm weather

This process is accelerated or retarded by the surroundings in which it is laid, and upon transport as rapidly as possible to the consumer under controlled conditions The economics of price does not come into discussion in this chapter, but the quality of the eggs and their attractiveness to the consumer, and the effect of neglect with this reducing the price received for the eggs is dealt with The eggs should be uniform in texture and of good size, and when broken open for use should be attractive with a sufficient depth of normal yolk colour, a firm high white indicating freshness, and be free of any signs of germination, bloodspots or unusual colours of yolk or white These factors are controlled by the breeding background, the correct feeding of the layers, care in handling of eggs, and the avoidance of undue delay in the sale of the eggs to the consumer

The producer is responsible for the first stage, and is paid on the basis of the grading of the eggs at the egg floor to which the eggs are sent Examination of the eggs cannot be carried out by breaking them open as described above, but by means of hand testing against a testing light or with the use of large mechanized grading machines Testers are trained in the technique of assessing the quality of the internal contents of the eggs as they are illuminated, and the rejection of any unsuitable eggs is carried out by them The illustrations which appear in this chapter give an example of some of the faults which are characteristic of reject eggs, and also what comprises the ideal egg

EGG CONTENTS AND FOOD VALUE

The egg contains proteins, minerals, and vitamins that are very important in supplying deficiencies of elements in fruit, cereals, and vegetables in the normal diet The value of eggs when comparing purchase costs with other products such as fish and meat can be assessed more easily on price per pound One dozen first-grade hen eggs weigh 1½ lb. (or ·7 kilo) for purpose of adjustment on this basis

Eggs are a highly digestible food product and are classed as a protective food. They contain nearly all the known vitamins, being particularly rich in vitamins A, B_2 and D Various minerals, listed as eleven in number, are also contained in eggs, and the protein value is high Eggs, besides being served in many different forms, are used in a variety of ways to improve the nutritive value, flavour, texture, and appearance of many other foods.

IMPORTANCE OF BREEDING BACKGROUND FOR EGGS

It is essential that eggs be handled correctly after they are laid, but many of the defects for which eggs are down graded occur before this stage. Some of these defects can be traced to feeding (which will be discussed later) but some of those related to breeding faults are as follows

1 Breeding birds laying small eggs will produce layers with the same characteristic—full size eggs should be set if it is desired to raise stock capable of producing good sized eggs Egg size is highly heritable, and part time records should be used to ensure that pullets reach full size eggs quickly Also select for uniform shape, and uniform colour

2 Egg shell texture is considered an inherited feature that good feeding will maintain, but many layers do not lay eggs with good shells even when given the best conditions The inability to convert these foods correctly is present, hence only set eggs that are of sound shell texture

3 The internal quality of eggs is an inherited characteristic Research work has shown inheritance factors with troubles such as

(*a*) the incidence of blood spots—can be reduced by testing eggs before they are placed in the incubator and setting eggs that do not carry the fault (as apart from stress factors such as rough handling of layers, loud noises, etc)

(*b*) the firm white factor in eggs—the percentage of eggs that will test out well is determined, to a large extent, by the type of eggs used for breeding This factor, essential if the yolk of an egg is to be held in position correctly, is a requirement of a high quality egg

The above reasons show the necessity for careful breeding and incubation practice The number of eggs does not mean everything in breeding—quality and ability to stand normal handling are vital to returns This may mean the elimination of some high producing birds, but it is essential that this be done In Chapter 9 on Incubation pre testing of eggs before setting was referred to as a practice carried out by many of the better operators—this is stressed as a recommendation for higher efficiency for those who carry out incubation

It is a well known fact on testing floors throughout the Commonwealth that many producers consistently market eggs that can be tested with ease, and have a very high export quality percentage Others, even in favourable weather, do not attain a high grading—and any consignments of eggs that contain a big percentage of eggs ' on the borderline ' are not good—the chances are that those that pass may not take long to deteriorate

The above shows that important requirements for egg quality are checking the breeding background, shell texture, and internal egg faults before eggs go into the incubator

LOCATION OF NESTS IS IMPORTANT

The type of shed in which the nests are located is a marked factor in producing quality eggs

The following suggestions are given

(*a*) Hot-weather conditions must be countered by suitable shed construction Where galvanized iron roofs are used, these should be painted on top with heat reflecting paint or be painted white This will lower the shed temperature by several degrees Aluminium roofs are very suitable for the hotter parts of Australia Asbestos roofs are also suitable for this purpose Aluminium foil insulating material under the roof will reduce shed temperature considerably Reject tiles have been used successfully

(*b*) The overhang of the roof should be carried out sufficiently far to shade the nests at the peak of the day's heat when these are located along the front for ease of collection The nest should also have a double lid cover If a nest is exposed to the sun the interior can be like an oven and egg quality suffers Nests located inside the front—with suitable opening for egg collection—are better practice Ventilation provision should be arranged in nests

(*c*) The shed must be capable of being opened up at ground level and have a sufficient opening at the rear of the shed just under the roof, to allow adequate circulation of air through the shed in hot weather

(*d*) Eggs should be collected within a few hours of being laid in hot weather, and taken to the egg room, where they should be cooled as soon as possible

SUFFICIENT NESTING SPACE MUST BE PROVIDED

Laying space must be ample Overcrowding in any way should be avoided Sufficient nests should be provided to allow of one nest for every six or eight birds where single nests are used or the colony or community type nest can be used Provide at least 1 square foot of nesting space for six layers in community nests

Although layers will tend to favour certain nests—a bird will usually endeavour to lay in the same place—a sufficiency of space must be provided to spread the laying as much as possible (The problem is greater in large pens than in small units) Therefore, for 100 birds provide twelve to sixteen single nests such as kerosene tins for birds up to 5 lb in weight, and 5 gallon drums for larger birds Circular drums can be efficiently used as well as the ordinary kerosene tin In cases where nesting material supplies become short because of delay in replacement, there will be less danger of cracked eggs than in flat-bottomed nests, as there will usually be some material at the bottom A community nest approximately 8 feet long by 2 feet wide will be necessary for 100 birds Further details on nests are given later in the chapter

1 First grade egg for home or export

TYPES OF REJECT EGGS

2 Tremulous air cell

3 Ruptured air-cell

4 Fertile egg showing germination after a few days in warm weather

5 Spider cracks, reducing to second quality due to rough handling

6 Olive or green yolk

7 Amber white

8 Floating or free air cell

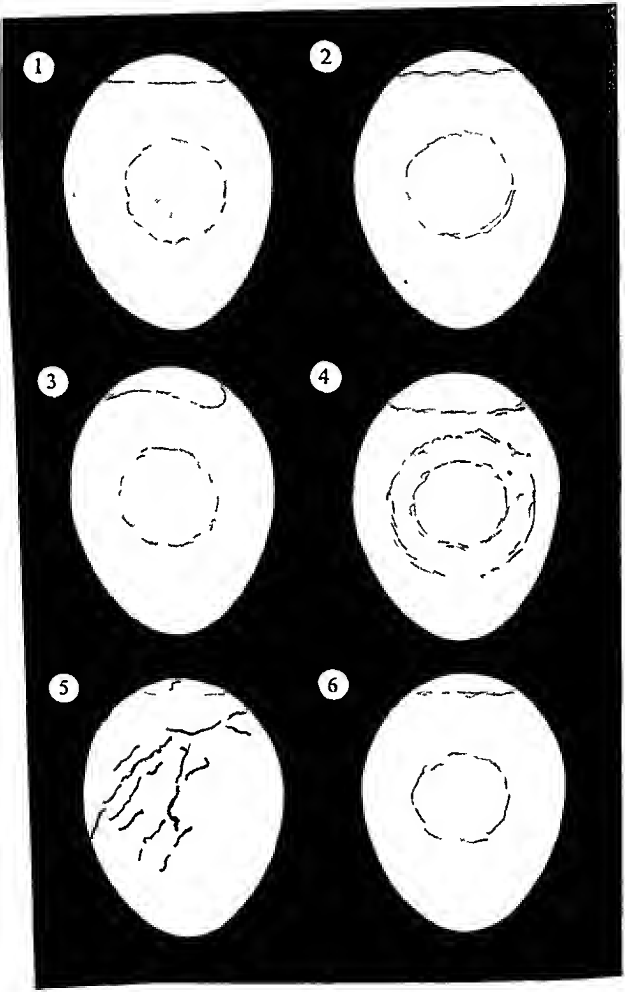
9 Floating yolk

10 Green white

11 Sunken yolk

12 Stuck yolk

[*See pp 400 402*]



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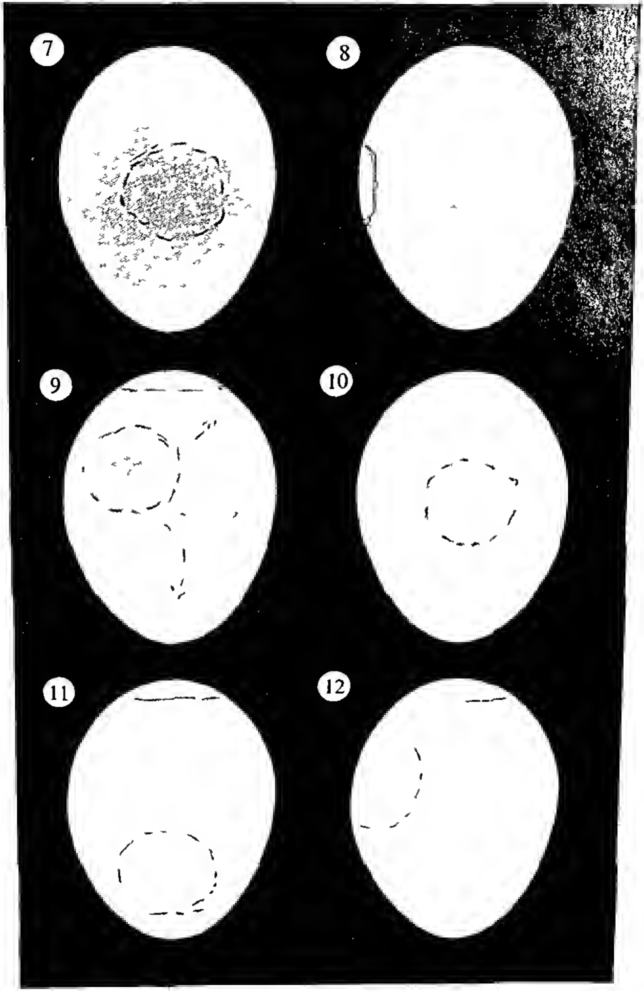
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BROODY HENS IN NESTS

Even in cool weather, eggs deteriorate when left in nests in which hens are laying, and this is accentuated in warm weather

If broody hens are allowed to remain in the nests, with their high body temperature and sitting closely on the eggs, the breakdown in quality is rapid For this reason, where heavy breeds and crossbreds are kept, a routine check must be made when eggs are collected in order that any hens showing signs of broodiness can be removed to a broody coop or another pen Nests constructed with the landing rail hinged in order that it can be put up at night help prevent possibility of encouraging broodiness by preventing birds sleeping in the nests In addition this prevents fouling of the nest, causing dirty eggs and breakdown of internal egg quality

NESTING MATERIAL—SUFFICIENT DEPTH ESSENTIAL

Some nests have been constructed with small mesh netting floors with a slight slope so that the eggs roll out to the rear of the nest ('roll away nests") The use of a community nest of this type well darkened inside has given reasonably good results in relation to egg cleanliness and the birds using them Others had padding with a hole in the centre for the egg to roll away In many instances birds lay a large number of eggs on the floor, when sloping nests with bare wire or tin floors are provided, and cold conditions prevail Also some cracking of eggs can be caused, and frequent dusting of the floor is a necessity Roll away nests have been used with colony wire cages with satisfactory results

The types of nests that appear to have given the best all round results under farm conditions are either individual nests, or better still the community or colony nest Shavings, where available at a reasonable price, are frequently used as the nesting material In community nests, where the darkened interior does not encourage scratching, many operators successfully use clean straw, rice hulls, white sawdust, shell grit, or similar materials (Materials such as shavings or rice hulls encourage use of the nests if birds are inclined to lay in the litter) Whatever material is used, there must be two to three inches depth maintained as a minimum in the nest, whether large or small, or eggs will be cracked against the bottom of the nest Sufficient depth of clean material is essential not only to prevent cracking of eggs, but also to keep them in clean sterile condition In laying cages light gauge floors will help keep cracks to a minimum and the wires should be kept in clean condition

CRACKED EGGS AND HOW TO PREVENT THEM

1 *Collect eggs carefully with suitable buckets* (or direct into fillers) * The rough handling of eggs when collecting is one of the big causes of the

* Where suitable conditions exist, with a concrete pathway in front of pens for a rubber tyred cart, or a pathway between laying cages, or with a mono rail and carrier platform through large sheds eggs can be collected direct in Keyes type fillers They can be all put together and graded out later for those needing cleaning, or clean and dirty placed in separate lots when using a cart When

percentage of cracked eggs that occur on the farm Eggs should be collected carefully—do not bump them together and do not overfill the baskets or buckets Only fill up to the level of the top Do not use buckets with thin sides (such as kerosene tins) because when they are packed the sides squeeze in and many spider cracks are caused Also, tins of this type retain heat for a long time Use stout wire baskets or suitably constructed galvanized-iron buckets with perforated sides, both of which allow the heat of the eggs to escape when they are collected and placed in the egg room Use a pad in the bottom of either the baskets or buckets (The need for this is stressed for reducing the number of cracks) Do not try to carry two buckets in one hand—this increases the side pressure Pick up the buckets and set them down gently Do not frighten the birds Collect the eggs carefully from under the birds—this not only avoids cracks, but birds disturbed and thrown from the nest when about to lay, or when they have just laid, can be a loss within a period—ovarian troubles quickly develop from rough treatment of this nature Tremulous air cells will also be caused by the rough handling of eggs at any stage on the farm or in transit (particularly if packed big end down) Place a cover over baskets in wet weather to help prevent dirty eggs Having two buckets in wet weather in particular is good practice, to place soiled eggs in one and clean eggs in the other This will save time in cleaning This practice, with baskets, buckets, or fillers will show a considerable saving on labour in the egg room Refer to the end of this chapter for illustrations of egg collecting baskets

2 *Number and condition of nests* The number of nests must be ample, as previously mentioned, and the depth of material maintained to prevent an excessive number of cracks

3 *Age of birds* Young pullets, once they have settled down to laying after the first month or so, during which period double-yolk eggs, and some soft-shelled eggs under the roosts at night may occur, consistently lay eggs of better shell texture than older birds, hence, not only from the point of view of higher average laying, but also for better shell quality, a high level of pullets should be maintained

4 *Frequent collection of eggs to save breakages and preserve quality* The percentage of "cracks" and also smashed eggs is kept to a low level by frequent collection of eggs Big pens (300 or 400 birds) are much heavier in labour requirements in this respect than small pens Three or four daily collections are necessary in big pens to prevent "cracks" and to have the eggs as clean as possible In small pens of ten to twelve birds,

collecting in suitable frames, made like a bucket to take fillers, they can be collected without the cart This method can save a considerable amount of labour with egg collection and packing, and reduces the incidence of cracks A considerable percentage can, if produced under good clean conditions, be transferred direct in the fillers to cases after cooling in the fillers in the egg room (Only the small percentage which actually need cleaning need be removed The top filler of eggs is taken off and the clean eggs in it used to replace any stained eggs taken from the next layer, and so on After checking in this way several fillers can be lowered into the case by a cord passed around them, with a light piece of wood used as a spreader at the top)

once or twice daily usually suffices, according to temperature conditions.

5. *Pack eggs in cases the right way—big end up—and do not allow movement of the fillers.* After eggs have been cooled properly in the egg room following collection they can be packed into the cases. The cases should be sound, well nailed, and constructed to prevent movement. Do not wedge eggs into fillers—keep bigger eggs for the top layer, although oversized eggs will be difficult to fit in. Pack carefully small end down (this is most important to prevent air-cell damage and rejection to second grade) and have extra pads at the bottom, at the top of the case, and also on the sides. The aim should be to prevent any movement of the fillers sideways or up and down in the case. Store the cases carefully under cool conditions before eggs are placed in and after they are packed until transport is available.

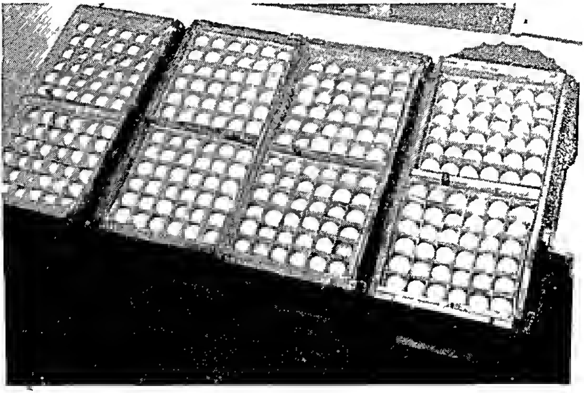


Fig. 142. Eggs reasonably well packed for market in ordinary 30-dozen egg cases. These should be packed with the large end up and conform to required weight standards. Also they should be clean and fresh.

CRACKED EGGS COSTLY

Studies made have shown nearly 3 per cent of "cracks" occur on the farm, but with careful handling on the lines set out this has been reduced to 1 per cent in many cases.

A 3 per cent loss on a weekly production of 235 dozen eggs from 1000 birds on a twelve-dozen average basis means seven dozen eggs weekly, which is nearly $2.50 per week with eggs at 35c. per dozen net. Where this is reduced to 1 per cent—which is possible of attainment—the loss is reduced to approximately 70c. per week.

It has also been calculated that a comparable average rate of loss occurs between the producer and the grading floor Eggs carefully packed, and the co operation of the carrying agent are necessary to reduce this percentage, which could be a comparable value to that shown above for "cracks" on the farm

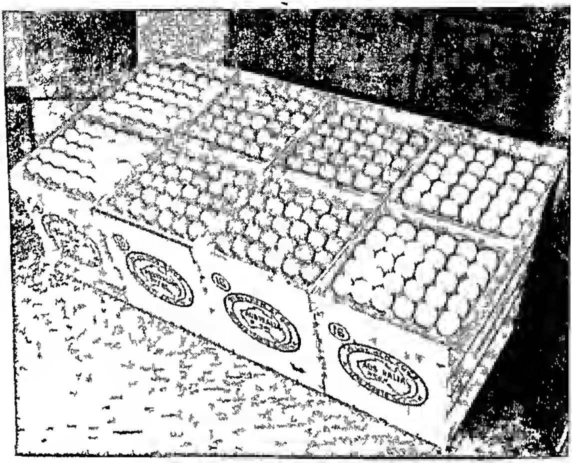


Fig 143 Eggs of export quality packed in export cases after being graded and passed by Commonwealth grading authorities These eggs have been checked for weight being well over 2 oz per egg, and are clean, stamped, and checked for internal quality and freshness then placed in Keyes type fillers

FEED AFFECTS EGG QUALITY

Feeding must be adjusted correctly to produce eggs with strong shells of good texture A sound laying ration combined with ample good quality greenfeed (in wet or dry form) is a basic necessity for the production of good eggs Some of the adjustments required are as follows

1 Shell grit or limestone grit is required in sufficient quantity to provide calcium for poultry and ample supply must be made available as free choice or included in the ration to enable egg shells to be produced

If used with a ration where no free choice of grit is available (as in a laying-cage feeding system), it is necessary to add 8 to 10 per cent in the mash with grain fed and when a high grade meatmeal is used, when all mash is fed, this should be reduced to 4 or 5 per cent Also hard grit must be provided for grinding purposes, and also to prevent excess consumption of shell grit in an endeavour to obtain grinding material This is a big

factor in good shell quality Calcium cannot be absorbed unless sunlight or vitamin D_3 is available to the birds, which brings us to our next requirement

2 Sunlight or vitamin D_3 is necessary for good egg-shell quality Where sunlight is available to the birds it would not be thought necessary to add vitamin D_3 to the ration However, birds outside in hot weather crowd into the shade, while birds intensively housed have sunlight only for a short period of the day, and this applies to a greater degree in batteries Also the factor of dull weather prevails—and the requirements are more for breeders than for layers A considerable cross-section of opinion today inclines strongly to the necessity of providing D_3 under all conditions for the general health of the birds, and for good shell-texture quality (Refer to Chapter 14 under Feed Deficiencies, pp 343-7, for quantities)

F N Milne, Senior Poultry Husbandry Officer, Queensland Department of Agriculture, in an article on "Egg Shell Quality" refers to the use of vitamin D_3 supplement as indispensable for the intensive system

3 Manganese is very necessary for good shell quality The production of good texture shells is not possible unless the feed contains a sufficiency of manganese A manganese supplement is needed in some mashes, e g all grain mashes Where egg shells crack easily with a slight shock, manganese deficiency should be suspected Heavy breeds need more manganese than light breeds Refer to Chapter 14 under Composition of a Mash and Effect of Minerals for further information and quantities needed (pp 352 4)

4 Water must be easily available and clean One of the causes of the fall in quality of egg shells in hot weather is insufficient drinking space It is most important that at least 6 feet of drinking space for 100 birds be provided In very hot weather extra water may be needed in the shed or very close at hand This need for ample supply is aggravated when dry mash is fed, and when greenfeed is not available Egg size is also affected It is also vital that water be kept in a clean condition at all times, or the flavour and keeping qualities of the eggs will be affected

5 Cool sheds are necessary Calcium is not assimilated as easily when sheds are hot Ample ventilation is necessary in heat waves and there should be a ground draught (through doors or shutters at ground level, in addition to a space under the roof at the rear of the shed), and the front should have an overhang to shade the shed Spraying by hand or automatically is needed in heat-waves Good production is governed by even temperatures

A spell of hot weather for a week or so, particularly with hot nights as well, often causes a marked down grading of eggs and easing of production for a period After the birds become used to the high temperatures, gradings usually improve, and also the laying (This has occurred where shade readings of 105°F to 117°F rule over a long period—and in Asian areas with prolonged heat) Prolonged holding of eggs in hot conditions causes the firm white to break down and run into the thin white, and the albumen becomes watery—this all adds up to the appearance of a stale egg, which will 'run out' when broken open

6 Heredity can cause some poor shells Some birds will lay poor-shelled eggs in spite of all measures as listed above and these come under the classification of birds with the inherent factor of poor shell texture Correct incubation practice should play a big part in controlling this by not setting eggs of this type These birds should be removed if it is possible to detect them (This is covered in detail under Breeding Background earlier in the chapter)

DO NOT MARKET FERTILE EGGS (PARTICULARLY IN HOT WEATHER)

The marketing of eggs from hens that have male birds in the pens can possibly be carried out in the cold winter months, without a risk of the eggs being down graded into second grade During warm weather this practice of sending fertile eggs will mean the possibility of a heavy loss to the producer if there is any delay in marketing Also, it goes farther than this—the eggs may be all right when graded if marketed quickly when temperatures are high, but when sent out to the retailer and held for a period germination commences This means that customers can buy eggs that were quite all right when graded, but they may not have been held at a low enough temperature by the retailer, or possibly they may be left out in the kitchen of the purchaser (instead of being placed in a cool safe, ice-box or refrigerator) These will then become "bad eggs" and the customer is dissatisfied, fewer sales are made, and so on This is an aspect which should be kept in mind as the demand for eggs on a market, and the expansion of markets, is always based on producing an attractive high-quality article, hence *market infertile eggs*

There is no reason for male birds being run with laying birds at any time unless the eggs are specifically wanted for incubation purposes Quality will deteriorate owing to the perishable nature of eggs held in high temperatures If infertile the egg will not usually "go bad", but when the holding temperature exceeds 70°F to 75°F and the eggs are fertile, then in two or three days germination will become evident and the egg is definitely second grade (Thermo-stabilization—holding eggs in hot water for a set period—can act as a control)

LOSSES IN MARKETING FERTILE EGGS

Economic aspects as to why fertile eggs should not be produced for market are as follows.

(*a*) Hens lay fewer eggs with male birds in the pens

(*b*) The number of layers in a 100-bird pen must be reduced to 90 laying birds when eight to ten males are present.

(*c*) The keeping quality of the eggs is always a gamble, and fertile eggs would have to be marketed three or more times weekly to hold quality

(*d*) The profit margin could entirely disappear during hot weather—transport or grading arrangements can be held up for various reasons

(*e*) In a heat-wave with temperatures around the century mark it would be almost impossible to market without down-grading Fourteen to sixteen

hours of incubation at 100°F. will develop a fertile egg sufficiently to enable detection, with a high percentage of accuracy, by means of a powerful light as to its being fertile.

The above reasons cover market quality, loss of space, and egg production The strongest argument of all is a possibility of heavy down-grading or even a total loss (a case of eggs normally worth $10 witn eggs at 35c per dozen and a slight down-grading only, has been reduced to nil less freight to be paid by the sender!)

MARKET EGGS FREQUENTLY

Market only clean infertile eggs, collected frequently each day in warm weather, and after sorting in a cool place, send them to market at least two and preferably three times a week It is vital to obtain good grading that eggs be sent in to the grading floor within three or four days of being laid and this is only possible by marketing twice or three times weekly If sent only once weekly it means that some of the eggs will be eight days old (as eggs are usually packed the day or night prior to the carrier calling or before being taken per own transport) These week-old eggs may have to wait a day before they can be graded, or over a weekend if sent on a Friday, and may then be nine to eleven days old, and it is almost impossible to maintain top quality even if the eggs were held in a good cool safe This means that a percentage must be down-graded Therefore make sure that at least two, and if possible three, consignments of eggs are sent weekly in warm weather

PRODUCE CLEAN EGGS

Production of eggs as clean as possible from the nest is essential for top-quality gradings (and saves cleaning work) therefore it is necessary to obtain clean eggs without washing

At one time eggs were washed either by hand or with egg-washing machines of various types to remove stains Investigational work with eggs being exported overseas, and with those held in cold store for the home market, showed that eggs that were produced in clean condition and did not require washing held their quality remarkably well when stored Eggs that had been washed had a high percentage of rejects from store It was found that the process of washing removed the protective covering of the eggs, and created a condition favourable to the formation of "black rots", so it was made a ruling in Australia that washed eggs could not be exported or stored (although quite suitable for sale on the ordinary fresh-egg market, unless they were badly stained eggs in the first place) Label washed eggs separately—so that they can be used within a short period (When washing is necessary warm water should be used)

The degree of cleaning permitted is dry cleaning by light use of a material such as steel wool to remove stains The use of abrasive type machines has a similar effect to washing Slight stains are permitted but not heavy stains

This condition has to be complied with as it is a further step in the marketing requirements with eggs Possibly some method may be evolved

eventually whereby the use of suitable detergents and water temperature will enable eggs to be washed *without loss of quality*.* Research is being carried out both here and overseas, and some degree of success is evident.

It would be much better from an internal quality viewpoint for consumers to accept eggs with slight stains as compared with cleaner eggs machine washed. Bacterial decomposition does not usually occur with eggs dry and clean. Wet cleaning allows the entry of bacteria (to greater or lesser degree—according to conditions of use) that cause rots. Some wet cleaning methods involve immersion of the egg in water for a certain period. In this case, to obtain best results possible, maintain sanitary conditions by changing water frequently as manufacturer recommends. Also, use correct temperature for water (about 120°F.), have adequate agitation, use recommended detergent sanitizer, dry eggs quickly after immersion.

METHODS OF OBTAINING CLEAN EGGS

Previous reference has been made to the necessity of providing sufficient nesting space (one nest to six birds or one square foot to six birds in community nests) and a sufficient depth of clean nesting material. Also broodies should not be allowed in nests and close nests at night.

Additional methods that can be adopted are:

1. The approach to the nest must be clean. If a free-range system is used then wire-netting-covered frames leading up to the nests will help. If colony type nests are placed at the rear of the roosting sheds, and the floor is covered with wire-netting, birds have to go over the netting before entering the nest. This helps to clean their feet.

2. Deep-litter practice is one of the most effective methods. Where birds are housed intensively and litter is in dry, friable condition, and the feathers and feet of birds are kept clean, the maximum number of clean eggs possible should be obtained. The Dryden type shed, giving excellent litter condition, and no access to night droppings, is particularly efficient for producing clean eggs. (See p. 232.)

3. The breed used will alter the percentage of clean eggs. Heavy breeds and crossbreds lay dark-brown and tinted eggs respectively, and these do not show the stains to the extent of White Leghorns. Also White Leghorns frequently stain their eggs when laying. However, high gradings of first-quality eggs are obtained by producers who have White Leghorns only, but cleaning is an easier task with the eggs from crossbreds and heavy breeds.

4. Where birds run out from a shed see that most of the eggs are laid before this is allowed in wet weather, under semi-intensive conditions, or where allowed to run out in the evening from an intensive shed.

5. Keep the floor wires in laying cages (particularly at the collection point), and the surroundings, in clean condition by brushing frequently. Also keep wires dry—avoid excessive use of spraying on the birds and cages, and give $1\frac{1}{4}$ to $1\frac{1}{2}$ sq. ft floor space per layer.

* The discovery of a suitable system would have a marked effect on labour requirements for handling poultry, as methods of this nature could considerably reduce time on egg packing operations.

A SUITABLE EGG ROOM

Provision of a room for holding eggs until marketed is a necessity on the farm Even with good holding facilities, the aim must be to get the eggs to market as quickly as possible An unlined shed will be quite unsuitable A solidly constructed shed with walls on the lines of those used for house building, and with a ceiling, will operate satisfactorily, but some form of cooling such as a cool safe (or refrigeration) is advisable

The cheapest type of egg room that will give good results, and one that has been used on many farms, is one built half or more in the ground The walls and floors are of cement or stone as a general rule, and at least four feet of the room is under ground-level A low temperature is maintained in hot weather (the desirable mark for holding eggs is 60°F -65°F), and the egg buckets and the cases, prior to packing and when packed ready for market, can be satisfactorily kept at a low temperature. The door can be on the southern side and four or five steps will be required to enter the room Wet bags can be used in the room as a simple method to maintain necessary humidity—this should be 70 to 80 per cent in an egg room This is a vital factor in holding egg quality—it stops eggs drying out too much

The size required need not be any arbitrary figure Sufficient room to store the cases, hold egg baskets, and have room for packing are the only requirements (An egg room seven feet by ten feet has been successfully used per 1000 birds, but this should be regarded as a minimum)

INSIDE EGG ROOM

EQUIPMENT FOR EGG ROOM

A wall bench or small table is necessary to stand the egg-weighing scales on, and also baskets or fillers of eggs being checked for packing A set of shelves is also handy for keeping egg records and for general storage purposes—for spare buckets, fillers, and flats A light is also necessary, as on a number of occasions it may be necessary to "catch up" on egg packing at night Also a testing lamp can be installed—this enables a check on quality on the farm to be made

Note If an efficient cellar can be used the results will of course be much better Also in hot weather the packing of the eggs is a much more pleasant job from one's own point of view than in a warm room Size and general details are as for the half-in ground room, but more steps are required

COOLING METHODS FOR EGG ROOM

A COOL SAFE

This is one of the easiest methods of providing a cooling system The provision of a cool safe is essential in a room built on ground-level with ordinary constructional materials (where power is not available). An efficient type safe or cooling cabinet will enable the inside to be held at around 60°F. to 65°F in hot weather by means of evaporation from the hessian curtains or sides of a cool safe A cool safe also makes it possible

Fig 144 1 Egg-room built half in the ground. This provides cool holding conditions for eggs and egg cases in the hot months An insulated roof is required and sufficient humidity should be maintained. Entrance from the south side is advisable Good holding conditions are vital to quality but should be combined with twice-weekly marketing

2. Inside an egg-room built half in the ground. Quality of eggs is preserved in hot weather if collected frequently. Cleaning and grading can be carried out under cool, comfortable conditions for the operator.

to maintain sufficient humidity in the room—a vital point (Eggs in a "cool" passage and draughts will spoil due to excessive drying out with low humidity.) These can be constructed in a number of different ways, but all depend on the "draw" or capillary action of the curtains either around a box or a frame. A tank of water is necessary on the top and also a tray or drip pan at the bottom to catch surplus water Towelling or flannel is best at the top, half in the water and half over the side of the top tray This soaks the hessian sides. Other systems use small taps set to drip down the sides. Water laid on saves the labour of filling the top tank—inlet can be controlled by a ballcock or valve. (Copper tacks should be used if tacking hessian on the frame sides.) The front of a safe can consist of hinged doors or a curtain pulled across.

The safe should be large enough to hold at least three days' eggs during hot weather. Per 1000 birds this means 1500 to 2000 eggs or sufficient room for five to eight buckets or baskets of one day's collection, plus about four cases of eggs packed from the previous two days, plus, if possible, two cases cooling to take a day's eggs—after they have cooled sufficiently, that is, when they feel cool to the touch (Holding against one's eyelid is a good check)

The cool safe shown in Figure 145 will hold nearly two days' collection of eggs on the lower floor, and two days' packing of eggs besides cooling some cases on the upper shelves This applies per 1000 to 1200 layers farmed. Two shelves hold egg baskets or egg cases. Both eggs and cases should be pre-cooled—never leave egg cases out in the sun.

DETAILS OF COOL SAFE IN FIGURE 145

This safe is simple and reasonably efficient, 5 feet high by 5 feet wide by 2½ feet deep, like a box without front or bottom. Leave a 6-inch gap at top of back where shown for ventilation. Put in the two top shelves 15 inches apart, the lower one 21 inches above the bottom shelf, which is 2 inches from floor-level. Place water tray on top and hang the front hessian curtain in the water. (A bound edge or hem with a pipe run through will hold it in place) The curtain hangs to within 3 or 4 inches of the floor. A long tray can be placed at the bottom to catch the drips (such as large D guttering closed and soldered each end). If a concrete floor is used a drain system could possibly be employed. Keep the water tray full and cool moist air will circulate over the eggs. Replace the hessian as necessary. The accompanying illustration gives an idea of constructional details.

Materials

2 sides, back and top = 125 ft of 6" x 1" timber flooring boards or packing case material. Sizes suitable to cut to 5 ft lengths	125 ft of 6" x 1"
2 top shelves requiring 4—5 ft lengths 4" x 1" = 20 ft for supports and 16—2½ ft lengths 4" x 1" = 40 ft for slats spaced 4" apart	65 ft of 4" x 1"
Bottom shelf requiring 2—5 ft lengths 4" x 1" — 10 ft for supports and 10—2½ ft lengths 4" x 1" 25 ft for slats spaced 2" apart	35 ft of 4" x 1"

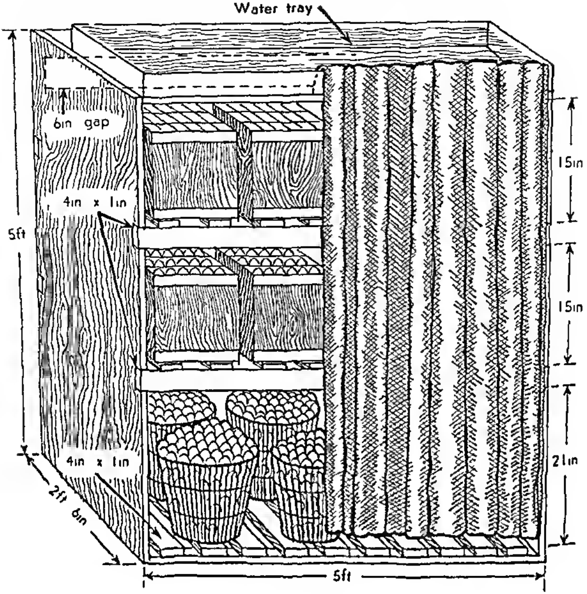


Fig. 145. Cool safe.
(This can be varied in size to suit materials available)

Cross pieces for construction of box—to hold 6" x 1" boards Four to each side, 4 for top each 2½ ft long = 30 ft and 4—5 ft lengths for back = 20 ft. These can be of 3" x 1" material	50 ft of 3" x 1"
Water tray 5 ft x 2 ft x 4" requiring a sheet of flat iron 6 ft x 3 ft or a 5-ft piece of 6" D guttering could be used with the ends closed with flat iron, and soldered. Also a floor tray to catch drips.	
Hessian—2 yards of 6-ft hessian and a 5-ft length of ½" galvanized piping.	
Total materials → Timber 125 ft of 6" x 1", 100 ft of 4" x 1", 50 ft of 3" x 1" (5-ft or 10-ft lengths suitable in all cases).	
Water tray and floor tray, 2 yards hessian and 5-ft piping.	

Note: Some alternatives are:

1. Safe to be of a frame with hessian sides and back, and tray 5 ft x 2½ ft to spread water over all sides by means of flannels or small taps. Safe

would need to be set in a large shallow tray in this case, as the drips would be on all sides This adaptation gives a larger cooling area and uses less timber, but larger corner pieces, larger trays, and more hessian are necessary.

2 The front can consist of hinged hessian-covered doors, which can be opened as needed Flannels draped over side of tray in front spread water over doors.

3 A very large safe, being a room within a room, can be made with bag or charcoal-filled sides This would be on the lines of a cool room instead of a safe, and has many advantages

Application can be made to your State Department of Agriculture for details of different types of cool safes suitably adapted for local conditions

The basic point is some form of cool safe, and should be adopted unless underground holding conditions are available

OTHER COOLING METHODS—AND REFRIGERATION

Where electric power is available other methods can be used which are more efficient under very warm conditions The egg room can be cooled by the following means·

(*a*) *A forced-draught system* set in a window of the room which can be covered with hessian either suspended in water or having water dripping down it from above A fan blows air through this into the room (evaporative type cooler) This cools the room and also maintains necessary humidity—under 70°F and 80 per cent humidity is desirable

(*b*) *The use of an air conditioner* set at the window of the egg room to draw air into the room and cool it by refrigeration coils in the unit If a humidifier is not included a fine jet spray set in front of this can be turned on as required This is a very efficient system The cost of this type unit can be a sound investment on a large farm (This type is sometimes used for cooling houses or offices)

(*c*) *The building of a cold room* in a section of the egg room on orthodox cold-store lines This is more the sphere of large plants, but for ordinary marketing purposes with the emphasis on quick delivery to the egg floor, it represents a heavy capital investment for a limited gain Very high-quality gradings can be obtained with the use of the cooling type fan unit and the air conditioner, also a cool safe or cellar with quick marketing

EGG-QUALITY CONDITIONS

The class of egg for the home market or for export should be a fresh egg with a small, firm air-cell not exceeding a quarter of an inch in depth The yolk should be well centred in the egg with the outline slightly defined and when broken the yolk covers only a small area The white of the egg should be clear and firm and when broken the thick white surrounds the yolk and there is only a small amount of thin white (Colour Plate No 1) (In a stale egg the thick white breaks down and runs into the thin white and the egg when broken runs out over a wide area and air-cell is half an inch or more in depth)

Shell texture should be sound and the egg should be clean, unbroken, and unwashed with only the slightest soiling The average size should be as near two ounces as possible Over-sized eggs are difficult to pack and under-sized eggs are down graded in value Every effort from the breeding, feeding, and nesting side should be made to produce as many of these eggs as possible to obtain highest prices

TYPES OF REJECT EGGS REMEDIAL MEASURES

Tremulous and Ruptured Air-cells (Colour Plates Nos 2, 3 and 8)

These are eggs in which the internal quality is good but because of rough handling either when collecting from the nests or in transport the air cell becomes movable One of the major causes of this trouble is packing eggs with the large end of the egg down in the fillers plus movement of fillers in the cases The weight of the egg contents is resting on the air cell when this is done This trouble can best be controlled by careful handling at all stages from collecting to packing of eggs and by packing eggs small end down (Also eggs being incubated should be tested before setting to remove any eggs with these faults)

Fertile Eggs Showing Germination (Colour Plate No. 4)

The necessity of producing infertile eggs has been fully explained earlier in this chapter Loss of quality in eggs is more rapid from this cause than any other, with a possibility of complete loss of the eggs, if combined with a delay in marketing when temperatures exceed 70°F to 75°F (shade readings)

The various points have been set out on this vital cause of down-grading mainly on sideline farms Commercial plants often offend, particularly with eggs rejected for incubator because of texture or size This also applies to suppliers of fertile eggs A notification slip on these eggs and packing them separately would be very helpful to marketing authorities, as these eggs can then be dealt with separately—possibly for quick consumption purposes (This practice would help expand egg markets)

Spider Cracks in Eggs (Colour Plate No. 5)

The reason for this prominent cause of rejection and down-grading is the rough handling of eggs by (i) bumping together when picking out of the nest, (ii) using a bucket without a pad at the bottom, and putting them too quickly into the bucket or picking up two buckets in one hand, (iii) filling the bucket too full, (iv) using buckets with thin sides which press in together when the bucket is lifted, (v) placing buckets on the floor or ground too quickly, (vi) packing carelessly and unduly shaking the eggs in the process, (vii) neglecting to put padding at the bottom and top of the cases and at the sides of the fillers, thus allowing movement within the case, (viii) careless handling of the cases in transport

These are some of the factors that have to be controlled to reduce the heavy loss incurred by poultry keepers when eggs are down graded to second grade owing to spider cracks

EFFECT OF GREENFEEDS OR SUBSTITUTES ON INTERNAL QUALITY

The internal quality of eggs is affected by breeding as referred to earlier in the chapter, but feeding is probably responsible for most rejects other than those due to delay in marketing or to hot-weather conditions Some of the various types of rejects and possible causes are as follows

Olive or Green Yolks (Colour Plate No. 6)

This trouble has been a cause of loss with a number of producers at various times of the year The hot months are the worst period for the trouble A percentage of these losses have occurred with a vitamin A substitute and no greenfeed used, and greenfeed has corrected the complaint Other cases have been reported where birds allowed range in greenfeed such as barley that has "gone down" and is very wet at the bottom—almost sloppy in condition—have laid eggs with a high percentage having this trouble In one case affected eggs came from birds on range, but on the same property birds in enclosed yards and fed chaffed greenfeed did not show the trouble The presence of weeds such as cress and shepherd's purse, and the feeding of rape exclusively, have been suggested as a cause Some eggs do not show the trouble until they have been held for a period in cold store It is a sound precaution to use good-quality greenfeed only, either in wet or dry form, plus a sufficient level of correctly balanced rations

Note The feeding of excess quantities of lush greenfeed is cited as a cause of what is known as heavy yolk This may possibly apply where the main ingredients are reduced in quantity below normal levels and replaced with greenfeed

Pink or Amber Whites (Colour Plate No. 7)

Tests, and farm checks, have shown that a high percentage of pink or amber whites have developed during cold storage when the eggs were laid by hens that had been fed excessive quantities of marshmallow as greenfeed over a long period This greenfeed also affects thick white quality in early stages Marshmallow should not comprise a high percentage of the greenfeed given

FLAVOUR AFFECTED BY WEEDS AND OTHER FACTORS

The flavour of eggs can be affected by various weeds, also by the feeding of garlic or onions The excessive use of sprays for vermin in the poultry shed can cause a flavour in eggs, also the feeding of treated or tainted wheat, or packing eggs in musty cases and fillers

OTHER YOLK COLOUR ALTERATIONS DUE TO FEEDING

Dark yellow yolks will be caused by a combination of heavy quantities of maize and greenfeed with the ration A South Australian test showed that eggs held in cold store which had been laid by hens fed cottonseed meal as the main portion of the protein of the feed developed a high percentage of "rots". Dark red yolks occur when hens eat locusts in plagues

The feeding of oil or powder form vitamin A as a substitute for greenfeed and its effect on yolk colour, by producing very pale yolks, has been referred to in Chapter 15 When sufficient lucerne meal is combined with the powder or oil, yolks of desired colour can be obtained

Note Golden yolk colour by natural methods is due to sufficient quantities of good greenfeed in wet or dry form and is a factor in producing an attractive egg for market as referred to earlier in the chapter

BACTERIAL CAUSES OF REJECTS

Watery whites This is a condition that occurs in eggs usually about the end of the peak laying season, and during continued hot weather It is associated with tremulous air-cells (Colour Plate No 2) and weak shells

The only safeguard suggested is to handle eggs as carefully as possible with conditions in the sheds, nests, and egg room as cool as can be arranged, marketing every two or three days Cases should be kept cool right up to the time of dispatch—not left out on a stand or landing for a few hours awaiting transport There is also evidence of this being an inherited characteristic This condition has been dealt with in detail by C F Anderson in the South Australian Department of Agriculture Bulletin 308

Floating yolks (Colour Plate No 9) This condition is indicated by excessive movement of the yolk, which floats to the top of the egg no matter which way it is held The chalaza breaks away from the thick white Birds fed organisms from the affected eggs develop the trouble within a few days This condition has been dealt with in detail by Platt and Anderson, *Journal of the Department of Agriculture of South Australia*, January 1939, "Experimental Production of Floating Yolks in Eggs"

Green white (Colour Plate No 10) *and green rots, sunken yolk* (Colour Plate No 11), *and stuck yolk* (Colour Plate No 12) These are conditions of bacterial origin They occur infrequently, although more prevalent in hot weather These conditions have been described by M A C Stidston, *Journal of the Department of Agriculture of South Australia*, October 1939, "Anatomy, Physiology and Pathology of the Egg"

(The Colour Plates Nos 1-12 have been marked with broken lines to indicate yolk positions etc more clearly)

ECONOMIC FACTOR WITH DOWN-GRADING OF EGGS IT CAN MEAN THE DIFFERENCE BETWEEN PROFIT OR LOSS

The cost of cracked eggs to the farmer was mentioned earlier on the basis of a 3 per cent total loss on a 1000-bird farm (with 12 dozen average as a basis and eggs at 35c per dozen) at $2 50 per week with a reduction to 70c to 80c weekly if this could be brought down to 1 per cent loss from this source

A consideration of the other causes of rejects would show that if only some applied to any degree another 3 to 5 per cent could easily be obtained The question of fertile eggs in hot weather could cause heavy losses For example, if approximately 250 dozen eggs weekly during January were being marketed per 1000 birds, and if the eggs were fertile and were delayed in marketing causing a 33 per cent rejection, this would mean

(with eggs at 35c net) nearly $30 lost in a week per 1000 birds Many and various suppositions could be made as to losses It is stressed that every care must be taken to observe the rules suggested earlier Even under the most efficient farming conditions a poultryman is hard put to get more than 95 per cent of the eggs produced into top grade This means with 5 per cent down-grading for only 12-dozen basis of production a loss of 10c per bird per year for down-grading of eggs including cracked eggs taking 35c per dozen as a suggested average net basis This is approximately $2 per week per 1000 at 10c per bird lost—if the 5 per cent were a total loss such as badly cracked, it would be 21c per bird or approximately $4 per week on 1000 birds

It can be quickly realized that even a 10 per cent loss on egg grading means a big sum weekly—the figure can be easily worked out for local returns Efficient operators can maintain under 5 per cent, and this is necessary for maximum returns

TIME FACTOR IN EGG HANDLING

MINIMIZE BY PLANNED ROUTINE AND CONDITIONS

Surveys have been made in various countries, and particularly in America, on the time taken for various tasks in order to streamline operations as on a factory production line This has been applied to poultry and one large-scale survey showed that 50 per cent of the time occupied weekly on a poultry-farm was dealing with the collection and packing of the eggs

Approximately one-third of the time occupied was rated for egg collecting or gathering, and two-thirds for cleaning, grading, and packing General observations have indicated that this figure would not be far wide of the mark and the question is "Can this time be reduced?"

STREAMLINING OF EGG COLLECTION

The time taken for collection can be reduced to the minimum by

1 Having the nests placed close by the entry door so that eggs can be collected by travelling straight through the pen instead of doubling back and forth in each pen

2 Nests can be located along the front of the shed, provided they are well shaded in hot weather—to obviate the necessity of entering pens (except to collect the odd egg or two that hens may lay on the floor, particularly heavy breeds) This will also apply with nests set inside the front of the shed and collecting the eggs through a slide

3 Community type nests reduce labour by reducing the necessity of moving one's hand in and out of each individual nest

4 On a large farm it would not be economic to go out for the daily collections, return with eggs, and go out with more buckets A transport vehicle is a necessity—either a rubber-tyred cart or a mechanical runabout Suitable smooth pathways are needed to facilitate this (On very large farms rail systems have also been employed)

5 The location of the sheds and doors is one of the first steps in streamlining this operation and this must be considered in the initial planning

Laying sheds are visited every day and this must be thought of—the sheds should be as close as practicable Do not have them made so that it is necessary to weave through yards and many doors for collecting A straight line is the shortest distance In intensive sheds either have nests along the front or communication doors between each pen—not into one pen then outside and back in again in the next, and so on

6 Have sufficient egg buckets If they hold 100 to 120 eggs each then have sufficient to hold three days' eggs to allow for eventualities due to sickness or accident This means 15 to 18 baskets should be on the farm per 1000 birds (Transferring eggs from one basket to another to "top up" to make sufficient space is the cause of much loss of time and many spider cracks) Also consider the question of collecting direct into the fillers as mentioned earlier—this can save a big percentage of time on collection and packing

7 Collections should be carried out frequently, particularly in large pens This will overcome soiled eggs due to breakages causing dirty nests, also the effect of crowding into nests is more pronounced in big pens Collection at 9 30 a m or 10 30 a m , 12 noon or 12 30 p m , 3 p m or 4 p m , and a final check late afternoon for late layers In small pens 11 a m and 4 p m should suffice These are suggestions only, to be varied to suit one s convenience, but the more frequent the collections the better the chance of being able to pack eggs without cleaning being necessary.

PACKING THE EGGS

1 Have the cases and fillers in clean condition, and have spare cases on hand A delay in the return of cases from the egg floor should not mean eggs stacked all around the egg room awaiting the cases It is sound economy to have things arranged to have at least sufficient cases to hold a week's eggs—this allows some to be away and the others packed by the time they return (This means providing twelve to fourteen thirty-dozen cases for every 1000 birds)

2 Have cases, fillers, and eggs cool in hot weather before packing—packing hot eggs just collected straight into the cases will mean heavy losses due to down-grading on quality Eggs will need several hours even in a good cool safe and a basket of open construction to cool down—if you put them straight into cases they may take nearly a full day to cool down properly

3. Do not leave the eggs longer than two days before packing—the job can become too big, and the standard of packing can deteriorate It means a better pack when this is observed (the two days referred to can be Saturday and Sunday—week-end routine can be arranged to cover the minimum of tasks—this is dealt with elsewhere)

4. Pack the cases correctly according to the grade required All hen-grade eggs should be packed together, that is, 1⅞-ounce or 2-ounce (52 or 56 grammes) and over according to the weight demanded, and medium and washed (and possibly fertile) eggs marked separately.

5. Get the eggs into the market within three or four days of being laid or in effect one or two days after packing. They are perishable just like cream—if left to be sent once a week only with high temperature readings, it means heavy down-grading unless ideal holding conditions are available.

The ideal conditions referred to for holding the eggs are a cool safe with soaked hessian sides, which provides cooling and also maintains humidity (or the use of refrigeration type units as mentioned earlier). Should a half underground room be used, moist bags hanging up in the room will serve, and strong draughts should be avoided. Excessive drying-out must be avoided: the provision of cool surroundings (60°F. if possible) and a reasonable level of humidity (75 to 80 per cent) will maintain high quality. This applies during the holding period on the farm, but does not remove the necessity to market within three or four days of being laid during hot weather.

The observance of the foregoing recommendations will bring the time of collection and packing to the minimum. The time it will take is too difficult a question to judge—no two people collect eggs in quite the same manner. Efficiency is considerably increased and time reduced after a month or so when handling eggs becomes more of an art with an experienced collector of eggs, whether from ordinary nests, community nests, or nests where the eggs roll to the back for collection.

Efficiency in this section of the poultry-farm is most necessary because all the good work done with general routine can be wasted if the final stage is not handled correctly.

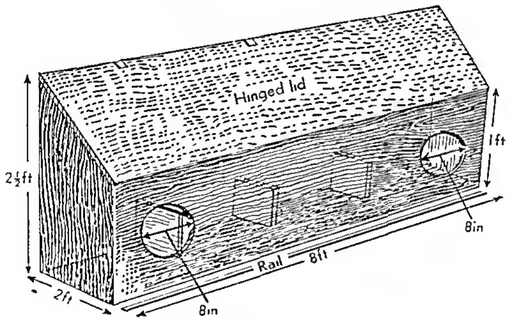


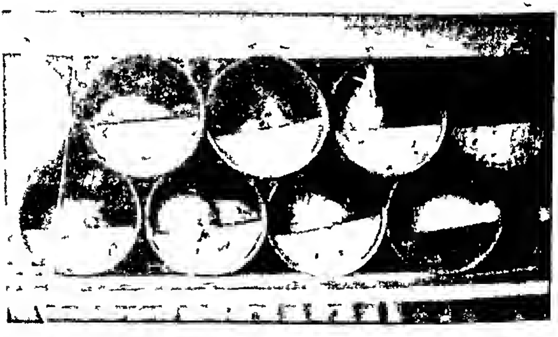
Fig. 146. Colony-type nest.

SUITABLE TYPES OF NESTS

The question of nests has been mentioned previously. The types of nests that can be used are not numerous. They consist of the following:

1 Single unit nests such as kerosene tins or drums with about two thirds of the top cut open and then placed in rows They can be set on their side with the two thirds open portion on top—the lower portion left keeps the nest material in place Set nests about two feet from the floor with a landing rail for the birds This is usually arranged so that it will swing up to close the nests off at night One nest should be allowed for each six to eight birds Usual nesting material, such as shavings etc

Fig 147 *1* Four gallon kerosene tin nests situated against wall of shed Note landing rail for birds in the front and also sloping cover to prevent birds roosting on top of nests



2 Circular 4 gallon drums used as nests These have been quite satisfactory Landing rail and sloping cover are used

2 Constructed community nests allowing at least one square foot of floor space for each six birds (15 to 16 square feet per 100 birds) These are usually built with a hinged lid, sloped to prevent birds roosting on the top, and entrance for a 100-bird nest would not need more than two circular openings about 8 inches in diameter A few small divisions inside the nest half-way across encourages spreading out the eggs Material used for nesting can be shavings, rice hulls, sawdust, straw or shell-grit

This is a successful type for speed of collecting, reduction of fighting for individual nests, reduction of cannibalism and feather-picking, and clean, easily collected eggs A suitable means of closing off the nest by raising the landing rail is advised Set two feet above floor (See Fig 146)

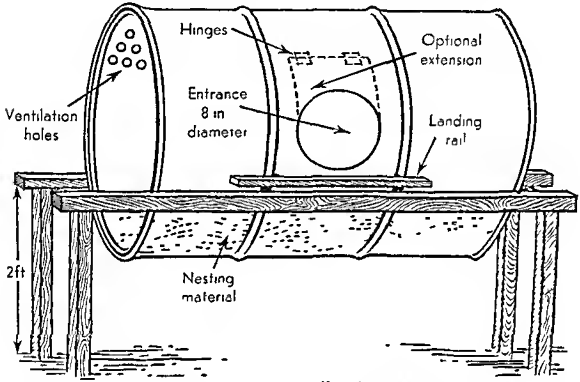


Fig 148 Forty-foor-gallon drum nest

3 For sideline farms an efficient nest can be made cheaply from a 44-gallon drom with an 8-inch circular hole cut in the side The drum is then set on its side aboot 2 feet from the floor and shavings or shell-grit placed in This gives a depth of 6 to 8 inches at the centre This nest will serve 50 birds of medium size Some have made collection slightly easier by extending the opening with a small hinged portion which is opened up when collecting This nest gives good results It should be set in a well-shaded spot or inside the shed

4 Nests of varioos types—some are marketed by proprietary firms—which have a roll-away system where the eggs can be collected from the back Provided that the wire bottom can be kept clean easily and breakages do not become a problem (also the question of the birds laying in the litter in cold weather arises) these nests will give good resolts When a solid bottom with a slope is used it will be necessary to dust the floor frequently or the eggs will stain as laid Inspection on farms where any particolar brand of nest is in ose will be the best guide in this case

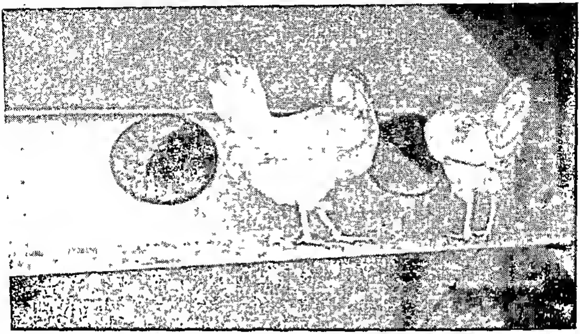
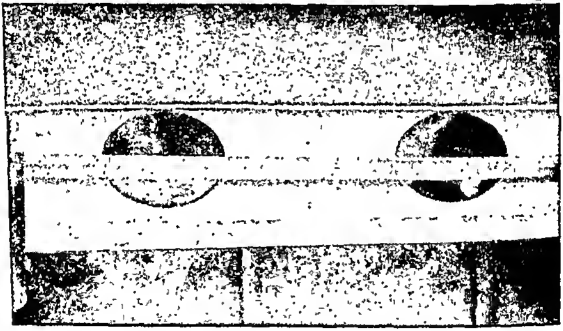


Fig. 149. 1. A colony nest with landing rail in down position. This is one of the most efficient types of nests for ease of collection and minimizing troubles caused by nesting arrangements; some of these are feather-picking and cannibalism. In very hot weather the lid should be propped up. Ventilation holes should also be provided in the upper portion of the ends.



2. Colony nest with the rail pushed up. This can be used to prevent the birds from roosting in the nest overnight. This provision assists production of clean eggs; the nest material is kept clean and broodiness is not encouraged.

PRESERVING EGGS

The question of preserving eggs may interest some. It is suggested that one of the best practices to adopt for home use would be the use of preparations which seal the pores of the eggs (on the lines of the oil processing of eggs commercially). The best method is by refrigeration.

The old method of water glass is still used by some and eggs provided they are of good quality and free from cracks when put in, will keep for some months Use one part water glass to nine parts boiled rain water When using eggs pierce air-cell with a needle The egg should be fully submerged (This solution may be used at a weaker strength) Eggs for storage or preservation must be first grade eggs free of internal defects and with sound shells

OFFICIAL REMINDERS ON REQUIREMENTS FOR FIRST-GRADE QUALITY

In an address to producers on the requirements of the marketing of eggs, W Whitehall, Supervising Dairy Produce Inspector, Department of *Commerce, emphasized strongly that even if a few points only were* adhered to grading returns would be satisfactory These were as follows, with special emphasis on the first point

1 Market eggs within three days of being laid

2 Provide clean fresh water for birds

3 Market and label washed eggs separately, as washed eggs will not keep in store

4 Pack eggs with the small end down, and send infertile if possible, but if fertile market very quickly The egg is sterile when laid, and good surroundings and quick marketing will give a good egg for the consumer at home or abroad, and although volumes have been written on this question the above points are the main essentials

SUMMARY OF RECOMMENDATIONS

Considerable detail has been given in this chapter on the question of egg marketing requirements, as it is considered most important that this question should be stressed It is not only the climax of operations as far as the farm is concerned, but it enters the selling field Whether on a permit sales basis, or through egg-floor channels, a quality egg sound of shell and with good quality fresh contents is demanded

The recommendations are briefly as follows

1 Eggs are a valuable protective food and should be marketed as a first-grade product by correct handling

2 Breeding background must be correct to have suitable size, shell texture, and good internal quality

3 Feeding must be on correct lines containing the necessary vitamins and minerals, and sufficient clean water must be provided

4 Sufficient nesting space, preferably with the community type nest, should be made available, and ample clean nesting material must be present at all times, and allow one square foot of space for each six birds

5 Cracked eggs must be kept to a minimum by correct handling methods to save heavy economic loss

6 It is very important that infertile eggs only should be marketed to obtain good grading returns

7 Clean and cool surroundings must be provided to produce clean eggs from the nest which will keep through storage periods Deep-litter practice is highly efficient in this respect—if birds are on range it is good practice to provide a wire-netting approach in front of the nest, and in cages keep the wire floors clean Plan the location of nests to save labour

8 Suitable buckets for collection are essential, combined with cool storage conditions and quick marketing in hot weather Also consider the question of saving labour with direct collection into fillers as described

9 The various causes of rejects outlined should be studied to eliminate this cause of loss

10 Care must be taken in relation to collection and packing efficiency—collect two or three times daily, market clean from nest if possible, and do not hold eggs more than a few days in hot weather

11 Pack the eggs correctly according to the minimum weight required, in clean cases, small end down Send the cases straight from cool holding conditions (65° to 70°) such as in a room with refrigerated conditions to market—do not let them stand in the sun Moisture content in a cool safe or underground room with wet bags prevents eggs from drying out It is again stressed that an egg room should have moisture to maintain sufficient humidity (75 to 80 per cent) and be free from strong draughts to hold quality—this is important Label various grades and washed or fertile eggs separately (This can make it possible to pay first-grade prices for these if they be disposed of for quick sale)

12 The eggs should be sent to the receiving floor, or the consumer if sales are made direct, at least two or three times weekly when the temperature readings are over 70°F if quality is to be maintained This is vital to good grading returns Quality loss starts from 70°F, not only when temperatures reach 100°F Sales at home or abroad depend largely upon quality of eggs marketed

EGG-GRADING STANDARDS

The requirements for first-grade eggs, and gradings for various defects, are as set out by the Department of Commerce and Agriculture for export grading purposes

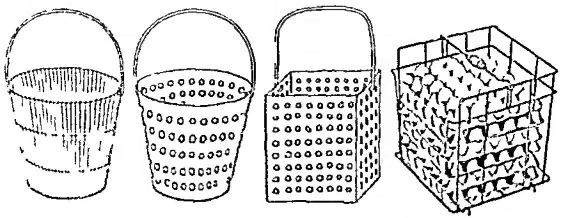


Fig 150 Baskets of this type are suitable egg-collecting baskets

CHAPTER 17

EFFICIENCY PRACTICES FOR EGG PRODUCTION

PART I

THE preceding chapters of this book have outlined basic requirements for poultry-farming These have covered assessment of possible costs and returns, farm planning, stocking the plant and general husbandry needs for hatching, rearing, housing, and feeding of stock, and marketing of eggs The purpose of this chapter is to cover general routine operations on the farm for the highest possible efficiency, by correct use of plant and the planning of routine tasks on a proper basis This will cover a wide field of various practices proved to be efficient

General hints and reminders on management points are also given Information is also given on some of the findings of the 1953-4 Poultry Industry Survey carried out by officers of the Bureau of Agricultural Economics, Department of Commerce and Agriculture, Canberra These were based on an extensive random sample of commercial poultry units throughout the mainland States of Australia Further surveys by the Bureau covering commercial units in the Sydney area 1957-60 period, and by the Victorian Department of Agriculture over this period, have also been made

Valuable information is contained in these on management practices This follows an analysis of information obtained from the various poultrymen by officers specializing in the assessment of business efficiency in the use of capital, land, equipment, and labour in various industries General findings indicate a high production per bird, and number of birds per man, among the top-level operators of the poultry-farmers checked in these Australia-wide surveys Reference is also made to this in Chapter 2, and see also pp 464-5

WINTER PRODUCTION LEVELS DECIDE RETURNS

The normal range of price-levels that has ruled for many years in Australia is governed by supply and demand On account of the difficulty of producing eggs during winter, supply is normally at low level As a result the price-range is usually higher than in spring, when production is easy with favourable weather conditions, and birds of any age will lay well

The efficient producer is one who obtains a high level of production during winter. This is entirely governed by the use of correct feeding methods (refer Chapter 14), the use of a high level of spring hatched pullets (refer Chapter 7, and tables given in this chapter), correct types of housing (refer Chapter 12), and the possible use of artificial lighting dealt with in the present chapter

Returns of a farm are increased greatly by the use of these methods because the extra production obtained on the plant is in the high egg-price period (The 1953 4 Economic Survey stated "when all costs, including the computed labour cost, were applied to the two groups [flocks under 50 per cent pullets compared with more than 75 per cent pullets] and compared with the gross farm income, flocks with a lower percentage of pullets had a profit of only 23 per cent of that of the group with the higher percentage of pullets This difference is partly due to the greater winter production from pullets when egg prices are highest")

EFFECT OF PRODUCTION AT DIFFERENT TIMES OF THE YEAR

This will be shown, on the basis of suggested egg prices, to illustrate the effect of production in different periods of the year For purposes of comparison the year is divided into three periods This emphasizes the effect of a high percentage of spring hatched pullets in increasing returns by higher winter lay, after allowing for increased rearing accommodation and feeding costs in raising the higher number of pullets (refer Chapter 7) The quantity of feed for raising a pullet is about the same as that required to carry a hen through the moult, but the production of a pullet for the year exceeds that of the second year bird by over 30 per cent, and the extra eggs are obtained while the older bird is in moult The overall picture must be taken of production for the whole year, and likely returns at various periods (See Fig 151, p 413)

How to Obtain High Winter Production

The various methods of feeding, housing, and artificial lighting, by which high winter production is obtained, are referred to in a separate section in this chapter With all methods a high level of spring hatched pullets is necessary as the basis

COMMENTS ON SYSTEM OF PLANNED REPLACEMENT

The above observations on the necessity to concentrate on a high level of spring hatched pullets are based on the normal high price-level in the winter period In some parts of the United States heavy concentration of commercial units of high efficiency has brought about a relatively even flow of production, which has resulted in a more even range of price If this develops further in Australia then it could be necessary to use a different approach to the stock replacement programme This would mean a stock level maintained at strength by frequent hatchings to cover mortality and culling (which can, under normal efficient conditions, account for about 25 to 35 per cent of stock in a year—10 to 15 per cent mortality and 10 to 20 per cent culling) A very high percentage of pullets would still be needed because of their higher rate of lay per month or per year

A plan for "More Eggs with Planned Replacements" outlined in a University of California Agricultural Extension Service leaflet is summarized It is based on raising 500 pullets every three or four months, involving brooding over the full year, to maintain 1200 birds at full strength, allowing for culling and mortality of 35 to 40 per cent in 15 month cycle.

Fig 151 (p 413), based on possible costs and returns, shows a margin of 90c to $1 32 per bird in favour of the higher pullet level unit over 12 months The net return of $2 18 to $2 60 is approximately double the return of the 50 per cent unit at $1 28, although expenses of the 50 per cent unit are only $3 against $3 30 for the 75 per cent to 100 per cent unit The average net price for eggs has been taken as 42c for 1st period, 31c for 2nd and 37c for 3rd (Culling indicated as possible in the 3rd period may pay earlier, based on trends of eggs and cull bird prices See also p 465)

The whole basis on which this practice depends for use is price structure With normal higher winter prices the greater economic return is obtained by concentrating on this period with spring-hatched stock This has been the normal practice in Australia with our high level of sideline production (See also Appendix 4 for further data on economics of part-year production For conversion, Aust $ is equivalent to £ 4 sterling or U S. $ 1 1)

USE OF ARTIFICIAL LIGHTING

Artificial lighting increases production during the off-time of the year under most housing conditions It is used with intensive housing conditions for best results This applies whether the birds are on deep litter or in battery laying cages, but is also used with birds in roosting-quarters with range conditions The practice used is to extend the hours of lighted conditions during the winter period to approximately those obtained during spring and summer in Australia The effect of light upon the pituitary gland of the layer is to stimulate the production of eggs during winter in large pens No gain has been shown with pullets in small unit floor pens The overall production of the year is not necessarily higher, although it may be increased slightly The benefit is the increased production during the high price period of the year, giving a more even distribution of eggs with a reduction of spring laying figures (Refer to Fig 151 covering production of the year in three periods) The practice has a high efficiency value where second-year birds are used by bringing them through the moult quicker (or are lighted after being "force moulted") and birds that were good layers in the first year and are culled give very good production under lighted conditions The increase with these can be up to 100 per cent and more on normal figures *for* winter period lay This has a particular value for stud breeders and those supplying fertile eggs to hatcheries to enable sufficient eggs when using known families for two or three seasons It also fits in with "part-year lay" programme as full advantage can be taken of winter period prices, *all ages* of birds are culled heavily in spring, as they moult following lighting

A point to watch with the handling of lights is that of regularity—they must be kept on at set times, as any variations cause moults The greatest gain occurs with large flocks, laying figures of small units are not necessarily increased, if hatched August to September period, owing to high level of winter production in small numbers In areas where winter conditions are mild and hours of available sunshine higher, pullet flocks

lay well, and would not give the same degree of response (All practices of housing techniques should be assessed according to conditions of area in which farm is situated) The practice is of considerable value in hilly, cold areas where pullets and old birds normally start production later than on the plains This means a loss of production during the off-season, and the use of lights is of particular value with large flocks under these conditions—and to help control "neck moulting" with early hatched pullets

METHODS OF USING LIGHTS

Lights are used for varying periods throughout the winter, and have been used in the morning, or the evening, or all night

Morning lighting This is the practice of lighting for a sufficient period according to the month of the year to supplement the hours of daylight until daybreak This practice tends to be the most popular with poultrymen because no "dimmers" are required to gradually break down the light for roosting as with evening lights The feeding rate should be adjusted for the rate of production—wet-mash feeding and grain at normal times *or* all mash feeding will give efficient results

Evening lighting This is the practice of lighting for a sufficient period at night, according to the month of the year, to supplement the hours of daylight It is necessary to dim lights gradually at the end of the period so that birds will go up on roosts This calls for a dimmer switch Time of lighting is same as morning lighting for corresponding months A dimmer would not be needed with birds in laying cages In hot weather lighting can assist feeding in cages during the cooler hours of the evening

All-night lighting This refers to the practice of using a dim light kept on all night, a time switch is not needed and results are quite efficient The birds go up to roost later and get up earlier than unlighted birds, but do not normally leave the roosts during the night (A variation of this has been reported of red lights of 10 watts spaced 4 feet apart 18 inches above the roosts left on for eight hours at night Poultry respond to red lights)

Midnight and flash lighting Reports from overseas indicate that the period of lighting has been used at midnight with success Dimmers are necessary with this system A report from Stoke Mandeville, England, also refers to the use of flash lighting, running a 1500-watt lamp for 20 seconds at 4 a m and 5 a m This was reported as less efficient than normal continuous lighting of the house

The various methods indicate that the light is responsible for the increased winter lay—and feeding requires appropriate adjustment

Lighting of growing pullets to adjust to sexual maturity Considerable material has been published on adjusting the rate of maturity by lighting, ranging from usual 14-hour schedule for mixed age groups to staggered step-down schedule for specific hatches to delay maturity of early hatched pullets, mainly on score of egg size All the State Departments of Agriculture will give local schedules for particular areas A suggested reference article is "Step down lighting", by G D Slennett, Acting Principal Livestock Officer (Poultry), N S W Department of Agriculture

RECOMMENDED PERIODS OF LIGHTING

The period is varied during winter months to maintain a 13- to 14 hour day This period agrees with consensus of all trials (although up to 15 or 16 hours has been recommended, however, present indications are that longer day or gradually increasing day does not bring any increase in egg production and it may have a detrimental effect on young birds Greenwood's controlled environment test at Edinburgh used 12 hours' artificial lighting with no daylight available at any time with excellent results) There is not a great deal of variation needed in Australia for the times to commence lighting For the south of Western Australia, South Australia, Victoria, and southern New South Wales switch on at the times given in Table 16 For the northern portions of Western Australia, New South Wales, and southern Queensland switch on half an hour later, and for North Queensland three-quarters of an hour later, than the figures given This will allow for the longer period of daylight in the northern areas at these times of the year

Table 15 shows why a certain period is set for switching on the lights Times shown apply along the latitude for Adelaide

TABLE 15

TIMES OF SUNSET AND SUNRISE EACH MONTH

		Sunrise	*Sunset*	*Hours of daylight*
	1st January	5 06	7 34	14 hrs 28 mins
	1st February	5 32	7 24	13 hrs 52 mins
	1st March	6 02	6 54	12 hrs 52 mins
Mid March period of lighting to maintain 13 hours to 14 hours day Mid-September	1st April	6 28	6 11	11 hrs 46 mins
	1st May	6 51	5 34	10 hrs 43 mins
	1st June	7 15*	5 12	9 hrs 57 mins
	1st July	7 25	5 15	9 hrs 50 mins
	1st August	7 11	5 34	10 hrs 23 mins
	1st September	6 36	5 56	11 hrs 20 mins
	1st October	5 55	6 18	12 hrs 23 mins
	1st November	5 14	6 45	13 hrs 31 mins
	1st December	4 56	7 15	14 hrs 19 mins

* The variations mentioned above will adjust for times of switching on lights for various months, for example—1st June, Brisbane 6 30 rise, 5 1 set = 10 hours 31 minutes, approximately half an hour more daylight

Note Electric light is safest, requires less labour, and can be controlled automatically Other lights have been used where no power is available for example, hurricane lamps for all-night lighting

TABLE 16

TIMES FOR USING LIGHTS IN THE MORNING TO PROVIDE A 13- TO 14 HOUR PERIOD OF ARTIFICIAL LIGHT AND DAYLIGHT

Month	*Switch on (approx)*	*Switch off (approx)*	*For Reference*		
			Hours of light given (approx)	*Hours of day-light (approx)*	
Mid-March	4 30 a m or 5 a m	6 15 a m	1¼ to 1¾	12½	
April	3 30 a m or 4 a m	6 30 a m	2½ to 3	11¼	Totalling
May	3 0 a m or 3 30 a m	7 0 a m	3½ to 4	10¼	
June	3 0 a m or 3 30 a m	7 15 a m	3¾ to 4¼	10	13¾
July	3 0 a m or 3 30 a m	7 15 a m	3¾ to 4¼	10	to
Beginning August to Mid-August	3 30 a m or 4 a m	7 15 a m	3¼ to 3¾	10½	14¼
Mid-August to end August	4 0 a m or 4 30 a m	7 0 a m	2½ to 3	11	hours
Beginning to Mid-September	4 30 a m to 5 0 a m	6 45 a m	1¾ to 2¼	11½	in each
Mid-September to end September	5 0 a m or 5 30 a m	6 30 a m	1 to 1½	12¼	case

The sunset and sunrise times (Table 15) from March until September to October the hours of daylight fall below 13 hours This is the period over which supplementary lighting can be effective Also it is not usual under most conditions to light pullets before five months of age The lights are usually started from mid-March (but best to start mid to late February or beginning of March) and run until mid-September (but best left till end of September or mid-October) Lights can be started without a gradual build up, if started in February/March Starting in May could have some build-up, but is too late for the most effective results Times are best tapered off gradually at the end of the lighting period This helps prevent the moulting tendency Lights are switched off at daybreak with the practice

of lighting in the morning This is the easiest method to handle and the one most commonly used (one reason being that no variation in lighting is needed with dimmers as with night lighting) Also morning lighting will give more eggs at the morning collection than when night lighting is used.

Check lights It is vital to success that the times must be regular once started Any upsets in routine can cause a false moult (Check globes and clean reflectors regularly—the light not coming on for a few mornings will cause a big fall in production)

Evening times If evening lighting is used the same daily period of time should be used, coming on at sunset This would vary from $1\frac{1}{4}$ or $1\frac{3}{4}$ hours to $3\frac{3}{4}$ or $4\frac{1}{4}$ hours daily, for example June would be 5 p m. to 8 45 p m or 9 15 p m Refer to sunset times shown on Table 15 for time to switch on lights, and for hours of light to be given each month check Table 16 (Incorporate a dimmer switch in this case to dim lights for a few minutes before cutting off)

Note Lights can be started mid to late February 5 30 a m. switched off 6 a m, then normal mid-March to end September period schedule, then till mid-October started 5 15 a m To be switched off from end September till mid-October 5 45 a m It makes the bringing on and cutting off of lights more gradual, prevents lowered production due to daylight and artificial light combined falling below 13 to 14 hours at any time, and can be of help with early-hatched pullets to shorten or prevent a neck-moult in February Lights could be used with small groups for this reason (see p 421), particularly with early hatching for "part year lay"—for example December to July production This schedule will also assist to minimize the spring time moult with lighted birds

NECESSARY EQUIPMENT

A 60- to 75-watt globe is needed as a *minimum* for each 350 to 400 square feet of floor space for ordinary floor systems—1 watt per 5 to 6 square feet—nearly 1 watt per bird (For all-night lights about one third wattage—1 watt to 15 to 18 square feet) For lighting battery-cage systems an increase in wattage is desirable, and if 15- to 25-watt globes are set at about eight-foot centres this will give adequate light distribution This is an important factor with cages as the birds cannot move to the light as with birds on the floor A reflector is desirable to conserve the light (unless lights are used with built in reflectors—the type of reflector used in the 250-watt infra-red lamps) For floor use at least one light point is necessary for every 100 birds (If desired a 40 watt globe can be used for every 200 square feet and would improve distribution) A time switch is needed so that the lights can be automatically switched on and off at set times Occasionally check the light in the daytime to see that globes are not blown and that everything is in good working order Set the lights against the overhead rafter about the centre of a 20-foot-deep shed slightly more to the front than the back (approximately 8 feet from front line of the shed would do) Place feeders so that they receive ample light. Improvised switches have been made by having an alarm clock placed and held tightly near the light switch A weighted lever rests on the winding key for the alarm and is

attached to the light switch When the alarm goes off the turning of the winding key dislodges the lever and pulls down the switch This calls for setting the lever and rewinding the alarm each day, and throws a big measure of responsibility on the operator Also the lights have to be switched off by the operator

The time switch is much more reliable, and also will save costs because it also switches off the lights automatically

COST OF INSTALLATION AND CURRENT CONSUMPTION

Costs of installation will vary considerably A price that has been suggested for a plant of 1500 to 2000 birds has been approximately $200 by contract For 2000 birds in 20-foot-deep sheds a minimum of 20 light points would be needed It is necessary to see that the wiring is properly installed and meets all safety requirements Check with an electrician (unless one is experienced with this type of work) The cost of power is not excessive To light 1000 birds for the mid-March to mid-September period (183 days) with an average of about three hours light per day would use approximately two units per day (under one unit per 400 birds daily) This would be 350 to 375 units per 1000 birds for a year If power cost 2c per unit it would be just over $7 (¾c per bird), 4c per unit just over $14 (1½c per bird), and so on for this period

ECONOMICS OF LIGHTING PRACTICE

The cost of installation and running are weighed against the price range for eggs One and a half or two dozen eggs extra per bird for the winter period as against eggs in the spring would mean the gain of the price variation between winter and spring price An example could be 25c for two dozen (if 12c between winter and spring price) plus possibly three extra eggs for the year could mean about 35c to 40c per bird, less interest on installation and running cost The rate of feeding can be expected to be adjusted by the operator to production level The whole gain is based on the price variation—when this is considerable it pays well The gain is mainly with early hatched pullets in large pens Refer to examples of production with and without lights, and returns of the year in three periods for the comparisons

ARTIFICIAL LIGHTING FOR FERTILE EGG SUPPLY

There can be an economic gain here Fertile eggs normally have a high value compared with market eggs in the spring period, hence the eggs from lighted breeders could show a substantial margin It would definitely be a payable proposition if one wished to use second year breeder hens (when a suitable market for fertile eggs was available) An example of the extra gain could be with two dozen eggs extra in winter period instead of the spring (if fertile eggs at 60c per dozen ($5 per 100) and 31c per dozen net for eggs in spring) Two dozen eggs at 60c per dozen = $1 20 compared with 2 dozen at 31c = 62c Net gain nearly 60c per bird in this case (less interest and cost of power) They could then be marketed at end of the spring

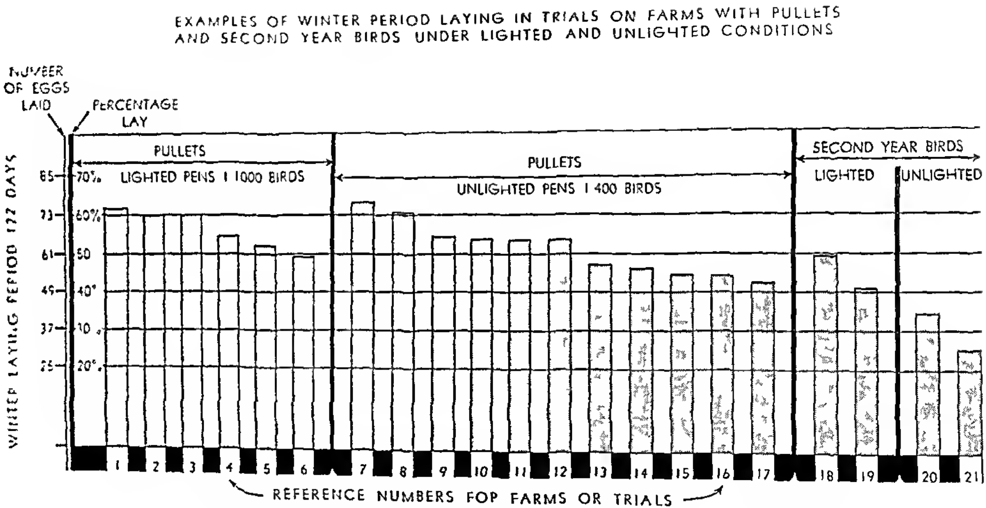


Fig 152. Examples of winter-period laying in trials or on farms with pullets and second-year birds

GENERAL POINTS ON LIGHTING

After being lighted, those birds that do not respond should be culled Normal feeding is used (See Chapter 14) The most effective response to lights is in large intensive sheds or battery cages

In shallow sheds 8 x 6 ft use 20 watt globes, and in 12 x 12 ft sheds use 60 watt globes set in divisions (Lights are optional for these small size pens —see pp. 239-43, 418 and 421-3 groups 1, 10, 11 and 13) In 20-foot-deep pens one light every 20 feet; if 30 feet deep then two rows of lights would be necessary. The main requirement is that with floor birds at least one watt of light be provided for 5 to 6 square feet of shed space, and that the light be well distributed in all areas of the house For cages provide nearly double this rate Incandescent light globes are more efficient than ordinary fluorescent for poultry They are cheaper to install, operate and replace They also match for wattage efficiency (Incandescent light is in the red part of the spectrum, and poultry respond better to this, also more efficient operation if shed temperatures are low)

The foregoing has given information on the general handling of lights for laying stock In summary, incandescent globes with reflectors, providing a 14 hour day and giving about 1 watt per bird floor space, appears best practice on present knowledge A reference to the columns on p 420 illustrates examples of winter production for different-aged birds under different methods of housing

DETAILS OF WINTER LAYING PERIOD RESULTS SHOWN ON THE ABOVE COLUMNS

The winter laying period covered refers to 1st April to 31st July This has been taken from the viewpoint of economic returns, as this is the normal period of highest prices for eggs The results shown on the columns are for various farms and trials carried out with pullets and second-year birds. Comparative results for lighted and unlighted pens are shown A description will be given, for each result shown above the reference number, of the type of unit or trial and conditions ruling in relation to breed, area, and feeding This may then serve as a guide, with local conditions known, as to desired practice

PARTICULARS

Groups 1 to 6—Pullets artificially lighted.

Group 1 —62% winter lay average 900 White Leghorn pullets—well-bred stock with proven background and bred and raised on farm Wet-mash, greenfeed and grain feeding Semi-intensive pens of 150 birds. Rainfall about 25 inches Twelve months' lay approximately 200

Group 2 —60% winter laying Results reported with pullets in single-unit battery cages under lighted conditions—reference T G Hardy. *Laying Batteries in Australia* (also other local and overseas reports indicate these average levels of lay for winter periods with battery cages).

Group 3 —60% winter laying average 1800 Australorp pullets, very well-bred stock bred and raised on farm Wheat and meatmeal free choice

and greenfeed (plus some choice of bran and pollard) Rainfall about 22 inches Intensive pens of 250 birds Twelve months' lay just on 200 eggs 66% of pullets on farm average (all stock) just over 14 dozen (Second-year birds force moulted and lighted)

Group 4 —50 to 55% winter laying Reported from West Australian pilot farms Crossbreds housed in flocks of up to 1000 birds, but principally under semi-intensive conditions with 150-200-bird groups All mash feeding system Twelve months' lay 200 and over

Group 5 —52% winter lay S A trial Ninety bird pens White Leghorns Wet mash, greenfeed, and grain, plus dry mash available Rainfall about 22 inches Semi intensive sheds

Group 6 —49% winter laying Mid August-hatched White Leghorns Good hatchery stock Dry manufactured mash, greenfeed and grain Intensive housing in 400-bird houses Rainfall about 21 inches

Groups 7 to 17—Pullets under unlighted conditions.

Group 7 —63% winter laying August-hatched Australorps hatchery-run stock Wet mash and greenfeed, with grain Housed in intensive 12-bird deep litter units Rainfall about 45 inches—hills area

Group 8 —61% winter laying Australorp and White Leghorn pullet entries 1953-4 S A official egg laying competition Feeding wet mash, greenfeed, and wheat Intensive single pens Rainfall about 18 inches Twelve months' laying 215 eggs per bird average

Group 9 —57% winter laying Australorp x White Leghorn cross pullets, hatchery-run stock 7th October hatching Wet mash and greenfeed fed with grain Roosting-quarters with range Rainfall under 10 inches on plains Each shed 170-200 birds Twelve months' production 196 eggs per bird average

Group 10 —54% winter laying August-hatched Australorp hatchery-run stock Manufactured dry mash, greenfeed and grain Housed in intensive 15-bird deep litter units Rainfall over 50 inches in hills area—cold conditions

Group 11 —53% winter laying Australorp and White Leghorn pullet entries in S A egg to layer 1954-5 test, hatchery section stock, hatched 10th September Housed in 10-bird units, fed on wet mash, greenfeed, and wheat Rainfall about 22 inches Fifty weeks' laying 194 eggs per bird hen housed average (1957-9 test 73% winter lay all crossbreds and 224 eggs hen housed average for the 50 week test period 1960-1 Random Sample Test 64 per cent winter lay all crossbreds March/June period, with 190 hen housed average for 9½ months lay—243 yearly equivalent Fed on high energy all mash 1959 61 Tests—see p 313 for ration)

Group 12 —53% winter laying. One thousand and fifty White Leghorn pullets, hatching dates late August, early September, late September Average winter lay for respective hatchings 50%, 52%, 57% Feeding wet mash, greenfeed, and grains Housed in intensive sheds of 350 pullets Well bred stock with proven breeding background bred and raised on farm Twelve months' lay approximately 200 eggs Rainfall about 23 inches

Group 13 —47% winter laying N S W random sample test of hatchery stock from day old Reared intensively and housed for laying period in intensive 12-foot by 12 foot pens for 40 birds Feeding dry mash and grain Full laying period from first egg laid to 16th March following year, 200 eggs and over for various groups

Group 14 —46% winter laying White Leghorn pullets September hatching, hatchery-run stock Dry mash, greenfeed, and grain feeding Pullets reared intensively and housed intensively in 400 bird pens Rainfall about 44 inches in hills area Twelve months' production 204 eggs per bird

Group 15 —44% winter laying Nine hundred Australorp pullets bred on farm Grains and meatmeal fed free choice with greenfeed Birds housed in 100 bird semi intensive pens Rainfall about 26 inches

Group 16 —44% winter laying S A trial Australorps free range housing Fifty birds in pen with roosting shed Feeding wet mash, green feed, and grain Rainfall about 22 inches Twelve months' laying 209 *average per bird*

Group 17 —40% winter laying S A trial White Leghorns Fifty bird semi-intensive sheds Wet mash, greenfeed, and grain Rainfall about 22 inches

Groups 18 to 21—Second year birds 18 and 19 lighted, 20 and 21 unlighted

Group 18 —49% winter laying Second-year White Leghorn hens in S A trial with lights Wet mash, greenfeed, and grain, plus dry mash available (Five and a half pounds dry mash used per bird—for 3½ lb extra weight of eggs laid—in addition to wet mash as for No 21 at same *period) Rainfall about 22 inches Housed in 100-bird semi intensive pens*

Group 19 —41% winter laying Second year Australorp hens in S A trial with lights Wet mash, greenfeed, and grain Housed in 10-bird unit pens Rainfall about 22 inches

Group 20 —35% winter laying Second year Australorp hens in S A trial without lights Wet mash, greenfeed, and grain Housed in 10-bird pens Rainfall about 22 inches The same conditions as for 19

Group 21 —27% winter laying Second year White Leghorn hens in S A trial without lights Wet mash, greenfeed, and grain Housed in 100-bird semi intensive units Rainfall about 22 inches Conditions as for 18—except for dry mash available in 18

Note See results for Group 11, 1957 61 re group size crossbreds and ration

COMMENTS

The general conclusion to be drawn from the information on lighting and the various examples given is that the lighting of layers is particularly effective in increasing production with large pens of pullets This enables winter laying comparable with small units These birds moult ' in spring, but small units unlighted do not Crossbreds White Leghorns and Australorps in large pens all give a particularly good response and this appears

one of its best fields with pullets, particularly in cooler areas Comparable results with different feeding systems give an interesting comparison It is also noted that unlighted birds in areas with mild winter conditions produce at a high winter level, as also applies with heavy breeds in cool areas in small units The high performance of well-bred pure-breeds and crossbreds can be seen, as well as the excellent results with random test hatchery crossbreds The interesting point in relation to pullets is that good results are obtained under many different systems of housing and group sizes, and both lighted and unlighted The question of whether it pays with pullets for market eggs is tied up with the price range, when a considerable margin exists between the winter and spring price, it is sound practice It is also noted that lighting is particularly efficient for increasing the supply of eggs from second-year hens, and with fertile egg values lighting can show a pronounced economic gain It can also make it an economic proposition to hold a percentage of good second-year birds and still obtain high-level winter and annual production with only 66 to 75 per cent pullets kept on the unit (See pp 413-4, also for part-year lay references)

Note The examples and comments given, also the tables and comparisons referred to, indicate the importance of adopting the right technique and system for the locality in which the farm is operating The decision will be based on whether warm or cool conditions apply, and the question of the importance of breeding background, time of hatching pullets, and pen unit size must be assessed

FORCE MOULTING

USE OF FORCE MOULTING WITH ARTIFICIAL LIGHT

The force moulting of birds near the end of the laying season has been used to cause the birds to go into moult quickly and then by means of artificial lighting to get them back into production for table or hatching eggs Where this can be successfully carried out it makes available earlier supply of breeding eggs from hens Eggs are much more valuable at this period for market or hatching than later in the year A technique used has been reported from both overseas and in Australia One report from Montana State College, United States, gave the figure of 52 per cent winter production for lighted force moulted birds, compared with 32 per cent winter production from birds lighted, but not force moulted (Compare with previous examples) The technique used was similar to that which has been described for Australian conditions The system is based on restriction of water and of food The system is covered in detail in "Force Moulting Suggested for Best Results in Breeding Pens" by R H Morris, Officer-in Charge, Poultry Branch, Department of Agriculture, Western Australia A general summary of the recommendations made for suitable stock is as follows

Selection of breeding birds to be left till February to March in normal way to allow culling for late moulters, and birds are used that qualify as good healthy breeders (Some further culling may be necessary after the force moulting period, as all birds do not respond to lights)

TECHNIQUE OF FORCE MOULTING BY RESTRICTING WATER AND FEED

Water Remove drinking water one evening during early to mid-March Do not supply any drinking water for the two days following except for one hour before the birds go to roost on the second day Remove water again and thereafter provide water for two hours daily only for ten days (about midday) Ample water space to be provided at these times to give all the birds sufficient room to drink at one time Extra vessels around the pens will be needed (or the birds will be distressed) By the end of twelve days production should have fallen very low, and normal water supply can be made available

Note Endeavour to select the time to have cool days for the first two days Care should be observed in relation to ventilation and temperatures during the remaining ten days (if a heat-wave occurred a start might have to be made again, but normally losses do not occur with stock that was healthy at start of period)

Feed During the twelve days of the water restriction period the feed is also restricted to no mash but wheat (or grain) fed at the rate of 6 lb per hundred birds daily for the first five days and then 9 lb wheat (or grain) per hundred birds for the remainder of the period During the twelve-day period greenfeed should be given at the rate of two gallons by measure to 100 birds daily (If unavailable, adding Vitamins A and D_3 in water is suggested) Production should fall to below 3 per cent by twelve days

Rest period Allow the birds a rest for two weeks following the force moulting treatment During this time they receive a full normal quantity of mash, grain, and water

Lighting Following this rest period the lights are switched on (April) starting about 4 30 a m ,* and production should increase with the birds laying well by mid-May

FORCE MOULTING BY ALTERING FEED ONLY

Some operators have achieved successful results with heavy and light breeds by altering the diet to grain only Birds were selected for breeders in the usual way and then mash feeding was stopped early March Birds were then given oats only, but as much as required, and as the only feed This reduced production to a low level in two or three weeks Birds were then artificially lighted and fed on a normal ration and production reached reasonable figures by mid-May This method has given a very good result without loss of body weight or much alteration to normal routine

WHITE LEGHORN HENS MOULTED BY MOVING

Some operators have obtained a reasonably complete moult by moving White Leghorns to another shed about March, and then lighting the birds following the break This has given good laying results by the end of May

*Then follow normal schedule as given earlier in the chapter

TABLE 17

AVERAGE LAYING RESULTS IN VARIOUS-SIZED PENS UNDER UNLIGHTED CONDITIONS WITH COMMERCIAL BREEDS

Note. Laying of pullets will vary during winter according to time of hatching during spring season and according to breed.

Month	*Spring-hatched pullets**		*Second-year birds*	
	Eggs per bird per month	*Average laying*	*Eggs per bird per month*	*Average laying*
April	9 to 12 Winter lay 46 to 58 eggs	30 to 40% Winter lay 38 to 48%	5 to 6 Winter lay 19 to 28 eggs	17 to 20% Winter lay 10 to 23%
May	11 to 14	36 to 45%	2 to 4	6 to 13%
June	12 to 15	40 to 50%	4 to 8	13 to 27%
July	14 to 17	45 to 55 %	8 to 10	23 to 32%
August	16 to 18	52 to 58%	13 to 14	42 to 45%
September	18 to 21	60 to 70%	17 to 19	57 to 63%
October	19 to 21	61 to 64%	17 to 19	55 to 61%
November	15 to 19	50 to 60%	13 to 17	42 to 55%
December	14 to 16	45 to 52%	11 to 14	35 to 45%
January	13 to 15	42 to 48%	10 to 13	32 to 42%
February	11 to 13	40 to 46%	9 to 11	32 to 40%
March	9 to 11	29 to 36%	8 to 9	26 to 29%
Average lay ..	161 to 192	44 to 53%	117 to 144	32 to 40%

* For the best period of measuring laying, up to fourteen or fifteen months may be necessary in order to record all eggs from all hatchings. Reports of work at C.S.I.R.O. Research Centre, Werribee, by F. Skaller indicate the first egg laid to end of March following year is the best period to cover all hatches from the spring season. (This allows for neck moulting with early-hatched pullets starting about December as compared with September hatchings, starting in April and no moulting, and variation of time to lay from different hatching months.)

FORCE MOULTING BY USE OF HORMONES

One report from the University of Wisconsin and a later report from the University of Maryland (C S Shaffner) stated that work was being carried out to control moulting time of hens The method was the use of progesterone, a hormone produced by the ovary of animals It is stated as successful in causing a moult when injected into fowls, and that birds have resumed laying by eight weeks following treatment

This practice could mean a method of force moulting that did not cause loss in body weight as with the water- and feed-restriction method

Note. The above references are given on the practice of force moulting This applies with the use of hens for breeding purposes or as a means of better lay from hens in the high price period It could be used at other periods of the year to alter time of lay to anticipate egg price trends

USE OF LIGHTING WITHOUT FORCE MOULTING

Some operators have obtained results in stimulating winter production from hens for breeding by using artificial lighting only as a means of hastening hens through the moult One trial with White Leghorns shown under the columns of winter production gave 49 per cent production for the winter period with lighting only, without force moulting A trial quoted for crossbreds indicated four months' laying of 56 per cent for birds force moulted and lighted compared with 41 per cent for birds lighted, but not force moulted

The various results indicate that artificial lighting, with or without the use of some alteration in methods of feeding, will give very much higher production figures (100 per cent increase or more) from second-year hens during the winter period, than the examples given for normal winter production in the schedule of laying under normal unlighted conditions in Table 15

COMMENTS

1 Table 17 gives a guide to moderate levels of monthly production and to the relative performance of pullets and second-year birds

2 Crossbreds in particular, and heavy breeds, may exceed the figures for April to July period and White Leghorns may be under This will be governed by breeding, feeding methods, and climatic conditions

3 Lighting of the pens will be expected to increase the laying for the April to May period (particularly with second-year birds) and a slackening during September to November can be expected (reference to laying under artificial lights is covered earlier in this chapter)

4 Laying results in small-unit pens can be expected to be above these figures in the early stages and the full period particularly with crossbreds

5 Pullets hatched in August and September would be expected to follow this range of figures fairly closely

EFFICIENT USE OF LABOUR AND CAPITAL

The first requirement to keep labour on an efficient basis is the lay-out of the farm. Various types of farms have been illustrated in Chapter 4, and illustrations on points for saving labour in attending pens follow in this chapter.

INTENSIVE UNITS USE LEAST LABOUR

The intensive type of unit involves the least amount of work in handling poultry as the distances are cut to the minimum. One estimate has given the distance covered on a free-range and roosting-quarters farm as up to ten miles per day. This compares with the possibility of only about half a mile daily being covered with intensive sheds 20 feet deep set close together holding 2000 birds, and set close by the feed shed. (This could be further reduced with a battery-cage or small pen unit.) Well-constructed units of this type take more capital, but if well built, maintenance is low as timber and netting outside depreciate more in yard fences than materials inside the shed. The use of earth floors for deep litter is quite sound to reduce capital investment. For labour efficiency the intensive type farm will be best. It is also the most convenient and pleasant to work in wet weather either by working through the sheds or under the shelter of an overhang in the front. The laying sheds should always be closer to the feed shed than chicken rearing yards, as they are tended the full year, but rearing yards only for a part. (Waterers in front also efficient. See Appendix 2.)

LAY-OUT OF EQUIPMENT TO SAVE LABOUR

The suggested lay-out of nests and feeders is shown later in this chapter. These cover the most constant of the routine operations. Water should be automatic and is not as important in respect of lay-out as it is not tended frequently. It is most convenient for cleaning out to have it along the back of the shed, or if inside it must be equipped with a plug so that when cleaned the plug can be pulled out, and the waste water flows through a pipe or drain.

MANY OPERATIONS THE SAME FOR SMALL OR LARGE UNIT

Many operations on the farm such as egg collection and handling will increase more or less in proportion to the number of birds (although a container half or three-quarters full of eggs does not mean many more in the carrying). Other investments and tasks do not increase in proportion. A feed shed can handle 2000 birds instead of 1500 without much alteration. Watering more birds does not make much difference when it is automatic. Filling a few more hoppers when you are actually on the job does not make much difference to the task. When a person is fully engaged on a job it is not much good being content with a lower income than can be made possible by handling another shed or two of birds or a higher percentage of pullets. The carrying of the highest number of birds practicable for the unit means that full use is made of the capital invested. Therefore, whether handling a sideline unit or a commercial unit, make it big enough to be an economic proposition in its return for capital and routine time involved.

EFFICIENCY PRACTICES

LABOUR FIGURE PER BIRD

Studies have been made both here and overseas and in the United St in particular of the labour factor per bird and have given a figure of o one and a half hours per layer per man What exactly does this mean ? is based on the number of birds which can be efficiently handled for operations One thousand five hundred layers handled over the year by man working 40 hours per week would mean approximately 2000 hou work for the year for 1500 birds, therefore would be one and a quarte hours per layer per man Two thousand layers handled by a man working 50 hours per week would be 2500 hours, therefore one and a quarter hours per layer per man This gives a general idea of the basis used It will be realized that the lay-out of the plant will be the big factor in attaining these figures, also the type of feeding used—dry or wet mash, mixed on the farm or purchased ready mixed, deep litter or open range, and so on

Note The hours per man basis includes all operations If a man handles 2000 or more birds by using family labour for egg cleaning and packing (or hires casual labour) the hours involved are a debit against the farm in relation to the units of labour employed For example, a man working full time with 2000 birds, plus 25 per cent extra time provided by the family or casual labour would reduce the birds handled per unit of labour to 1600

YARDSTICK FOR DETERMINING EFFICIENCY BASED ON EGGS PRODUCED PER MAN

Various standards are quoted in relation to the farm to be handled by one man or the number of birds per operator as efficiency This can be a good basis on which to operate, but the criterion of success on a farm is not necessarily the number of birds carried These may be producing at a low rate of lay On the other hand, a person may be able to quote a very high output per bird, which is also efficiency, but insufficient birds carried on the unit will mean that it does not produce a payable return Hence it is suggested that a basis upon which to work should be output of eggs per man, which would cover it either way For example, a man handling 1600 layers producing 15 dozen per head would produce 24,000 dozen eggs in a year A man handling 2000 layers producing 12 dozen per head would also produce 24,000 dozen The man in the first instance could show, if feed cost $3 per bird per year, about $1500 more profit by feeding 500 fewer birds Another example could be an efficient farm of 1400 birds producing at 15 dozen rate marketing 21,000 dozen eggs This would be just as efficient as 2000 birds at 13 dozen rate producing 26,000 dozen eggs, if feeding expenses per bird were $3 year and eggs 35c per dozen net The first farm with 1400 birds would save $1800 in feed and expenses as compared with the other The second farm with 2000 birds would have an income of $1750 more than the other with 5000 dozen extra eggs produced The saving on feed in the first case would counterbalance the increased return on the other farm, but less labour in rearing, housing, and cleaning would be needed in the first case This would be the most efficient unit

Hence it is necessary to consider all aspects of the question—smaller

units and more eggs per head can give as much profit to the farm operator as more birds in big units and a lowered output (General results indicate that management efficiency falls on very big units with a lowered output per bird, unless good managerial ability and a knowledge of stock husbandry are incorporated in the one person) The Bureau survey results showed high-efficiency farms ranging from an average of 1564 birds with 15 94 dozen and over average (13 per cent of farms in survey) to average of 1771 birds with 14 04 dozen average (33 per cent of the farms in the survey) The output thus ranged from up to 24,000 dozen to 25,000 dozen per farm on 46 per cent of the farms investigated

The dominant factor on the production costs is the yield per layer, and a unit will be profitable if this is high, provided that a reasonable number of birds is carried, hence a basis of 1500 to 2000 layers can be efficient according to lay per bird Therefore, if 24,000 dozen can be produced by 1600 birds at 15 dozen per head, it would represent much higher efficiency than 2000 birds at 12 dozen per head, and a greater degree of profit owing to saving of feed for layers Hence a basis submitted for efficiency is an output of 25,000 dozen eggs per operator, and 30,000 dozen per operator for high efficiency * The lowest possible number of birds must be used to attain this figure, and must be coupled with low feed usage per dozen eggs

(If an operator was achieving this high efficiency result with growing of greenfeed and mixing feed on the farm, a possible extension to 35,000 dozen eggs could be considered with a complete prepared ration, and possibly having 250 more birds Keeping "bird levy" basis in mind, and need for minimum level, costs of each could then be compared)

EFFICIENCY OF OPERATOR DECIDES PROFIT MARGIN

The efficiency of the operator, as stressed elsewhere, decides the returns of the poultry unit The human factor is the biggest single factor in deciding the final returns with poultry

The starting of a poultry-farm just for the sake of independence, and without the desire to "knuckle down" to the routine requirements involved is not likely to end up successfully A training in a particular profession is a very big help indeed Also the ability to handle other lines of livestock production efficiently gives the basic approach to keeping poultry In this case, the need for correct feeding, sufficient room, and routine operations is taken for granted by virtue of the success of operations in other lines For example, many excellent plants are operated very efficiently as a large unit on properties carrying sheep as the main line of production

In the Bureau of Economics survey, 1953-4, which was very comprehensive in its coverage, a wide range of aspects that could have an influence on returns were dealt with, and the following interesting facts concerning the persons engaged on the farms emerged:

1. The highest percentage of people making a profit among the farmers

* This method of calculation also covers the average level of stock over the year For example, if talking of 2000 birds per man, and pens for 2000 birds, the normal mortality and culling over the year means 1600 at end of year or 1800 average. To maintain 2000 average would need pens for 2250 birds on the unit.

selected were previously engaged in clerical or professional work (69 per cent making a profit) This was matched by those previously engaged in farming (68 per cent making a profit) This also ties up with the success of the great number of good units seen on efficient general farms The results indicated that a basic training was valuable for the poultry farmer

2 An analysis of reasons for entering poultry-farming showed that the smallest percentage (41 per cent) making a profit were those who entered the industry only from the point of view of wishing to be independent It appeared that many were not prepared to carry out the constant routine associated with poultry-farming

3 Other interesting figures were given concerning the success of people who entered for various reasons A very high percentage of those making a profit (66 per cent) had entered poultry-farming because of economic depression (and hence had been engaged in the industry for a long period) This was closely followed by occupation on retirement (62 per cent), those entering because of small capital outlay needed (57 per cent) and preference for the occupation (54 per cent)

These points indicate that certain qualifications are necessary for success, and also the importance of the personal factor

THE ONE-MAN FARM AND ITS OBLIGATIONS

The majority of poultry units conducted as commercial farms are handled as a one-man farm, frequently aided by the family in egg grading and packing This works out quite well, but some complications arise owing to the continuous routine work with poultry Recreation leave is difficult when working with poultry (although breaks occur between routine during the day) and periods of sickness can create major problems—which in many cases have been overcome by considerable family co-operation Farms employing feeding systems, which only require refilling once weekly, plus automatic watering and deep litter, are safer and easiest in this respect At a pinch, the routine for some days (always hoping that it does not occur in the busy chicken season) can, and has been, carried out by the family, as it can be cut to egg collection and packing, and replenishment of feeders

Many one-man—or one family—farms have been efficiently run throughout the Commonwealth in this manner—with a family rally round for "our farm" in emergencies However, some schools of thought on this question consider that one of the most efficient farms can be one large enough to have two men as partners This can be the case when people of ability and compatible natures are associated This can reduce some of the obligations of the one-man farm by allowing the working of alternate week-ends, an annual break for recreation, and a safeguard for sickness If this cannot be arranged, another possibility is the employment of an operator who receives a reasonable wage, plus a percentage basis on results—as the personal factor of interest and attention to small details means so much in poultry farm efficiency These are questions for personal decisions (The operation of a very large plant enters a somewhat different sphere and the ability of the owner to handle management problems on a

large scale becomes involved The running of a large plant as an investment, without a good husbandry knowledge, involves the necessity for a qualified husbandry-man controlling the plant with a personal, and percentage basis, interest in the unit)

PLANNING EQUIPMENT AND PLANT LOCATION

Save labour by correct placing of sheds, nests, feed hoppers, or troughs, and chicken-rearing quarters

The distances to be travelled for the various routine jobs on the farm, particularly for feeding and egg collection, should be cut to a minimum These operations can mean about three and up to six trips daily right around the laying sheds at certain times of the year. Cutting the distance in half can mean a very big saving of labour This can be one of the biggest factors in the number of birds a person can handle with a reasonable

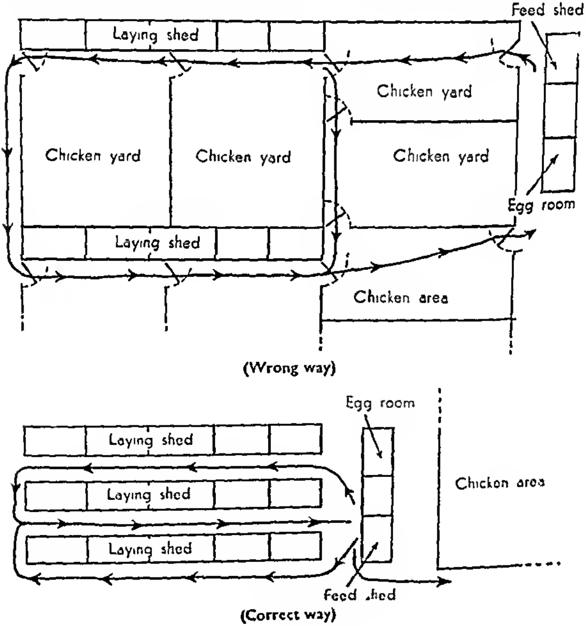
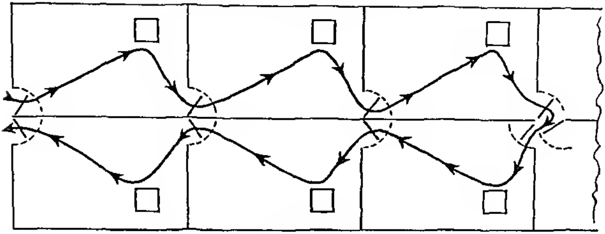
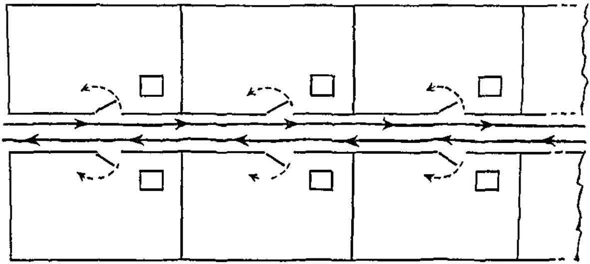


Fig 153 Laying sheds feed shed, and chicken yards



(Wrong way)



(Correct way)

Fig 154 Layout of range rearing for young stock

amount of work Various types of units, whether small-pen units, battery cages, or intensive pens of larger types, can all be handled in payable numbers efficiently if the farm set-up is designed correctly The farm designs shown in Chapter 4 are designed for the minimum work requirement, although naturally open-range farms cannot be handled in the same distances Other factors referred to previously have an influence in these types of farms The intensive-type farm can be worked with less labour than any other system such as semi intensive or open range, (this applies whether intensive deep litter units—large or small—or cages are used) Also wet-weather handling is very much easier for the routine tasks (and less egg cleaning is necessary) The illustrations that follow with suitable comments attached give some suggestions on points to keep in mind for sheds and fittings

There are other important points in planning a farm lay-out besides efficiency of handling operations

The lay-out of a farm has to be planned so that operations can be carried out by travelling the least possible distance and so that the work at each point be as convenient as possible There is more to it than this One point dealt with later is the question of fire control A second important point (mentioned in the Disease section) is that of disease prevention

This means having the rearing-quarters and the brooding-shed isolated from the laying-quarters. Isolation is particularly important during the first thirty, and up to ninety days of age. (If mortality has been experienced with leucosis it has been suggested that isolation should be carried out properly by handling the brooding section with different clothes and boots from those used for tending the laying birds.) It is also an advantage to have a farm remote from other farms if possible.

The third and final point, but one that can be the most important with many farms, is that of the effect of a well-laid-out plant upon the farmer. A farm which is a jumble of varying types of sheds necessitating weaving in and out of various pens to get to another and so on, is depressing to handle when the job involves attention practically every day in the year. The operator eventually becomes "sick of it", both from the extra work and the necessity of apologizing to any visitors.

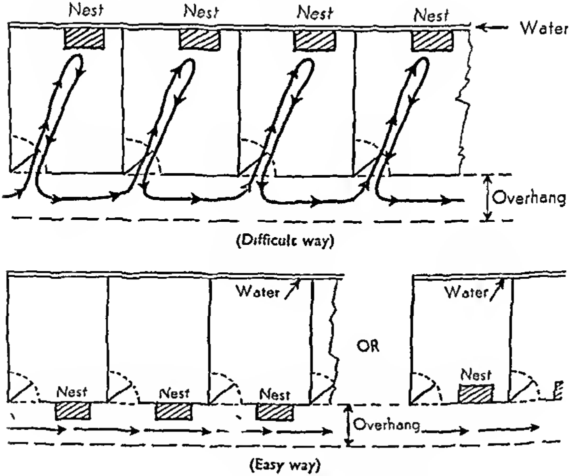


Fig. 155. Suggestions on placing nests for easy collection.

Compare this with the pride of a good farmer in a well-laid-out plant complete with well-planned windbreaks, shrubs, and trees. It is not only easy to work, but is a source of pride of possession, and gives a great deal of pleasure in showing the farm to visitors and friends. Farms of this type can be a credit and an example to a district, and are a source of satisfaction to the owner.

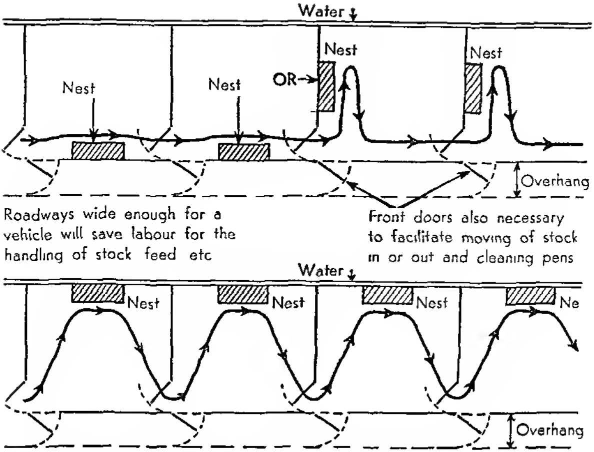


Fig. 156. Suggestions for nests in large pens to reduce egg-collecting labour.

The doors between pens, and nests near the front of the pens as shown at top, save time and work.

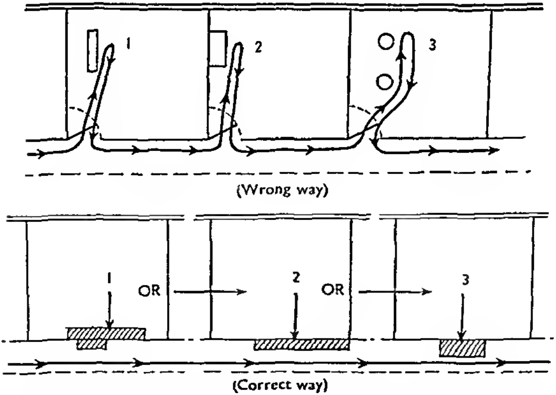


Fig. 157. Suggestions for reducing work in handling feeding in small pens.

Location of feeders as shown (shaded) is suitable for dry or wet feeding systems.

P

PLANNED ROUTINE FOR THE FARM

Reference is made later in the chapter to a routine of operations for the year. It is desired to give here some suggestions on the planning of the farm's operations including the need for financial and stock records, and also how the routine daily tasks are likely to be split up

KEEP FINANCIAL RECORDS

This is a vital factor in successful operations. The whole success of the farm depends on the ability to plan correctly for the year The revenue on a poultry-farm varies considerably over the year owing to fluctuations in production levels and prices, while the costs of feeding and working expenses are relatively constant for the laying stock, and cannot be reduced below a certain level (plus extra outgoing when raising young stock) This calls for a business-like approach to try and see that reserves are built up for the lean periods A keeping of a normal record of receipts and expenditure soon gives the lead after a year or so on this question Look ahead for likely returns if possible to gauge spending, and also the outlay for the pullet-rearing period Keeping records overcomes the tendency to panic when prices may fall unexpectedly—all primary-production lines have lean periods at some time Put capital expenditure separately from the current feed and working expenses, otherwise in a period of expansion it is very difficult to know if it is really paying or not Also, allowance must be made for depreciation or heavy replacement costs may occur in a single year Interest on capital must be allowed also to assess correct return for labour and management

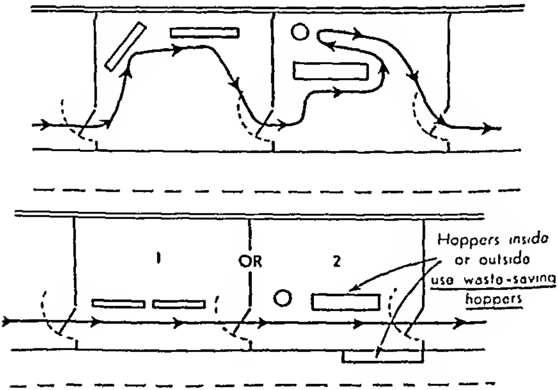


Fig. 158 Suggestions on placing feeders in large pens to reduce labour.

GENERAL FARM STOCK RECORDS ARE NEEDED

Certain records should be kept on a farm If incubation is carried out keep a hatching record—it is helpful to compare one season with another Possible improvements can be carried out if results fall much below a previous year—the reason will be checked If no record is kept it might be forgotten

Keep a farm egg-production record—it is not much trouble to have a card for each shed The daily egg tally is entered on the card (which can also have space for number of birds in the pen at the start of the year, and culls and dead birds removed) and it makes a valuable record, and a check for production and health Any slump will be easily noticed It is a sound policy to have the daily totals for comparison purposes—these can show whether the average lay is improving or not

The keeping of basic records of this nature will not take a great deal of time if it is done as a regular job, but it puts the farm on a really business-like basis, and efficiency cannot be achieved without it (a budget approach) The surveys carried out in New South Wales and Victoria have shown the value of keeping records as a means of detecting weak points in management

DAILY ROUTINE

There are certain routine jobs, which must be done These are feeding, egg collection, checking waterers, packing and grading of eggs, culling, cleaning, or checking litter condition, repairs, and checking for vermin In the breeding season, handling brooders and rearing-quarters, together with general husbandry needs of the young stock are added to this list It is very difficult to set fixed times for these operations for any given number of birds, because the aptitude of various people varies greatly on some of these operations A suggested basis will be given as a guide later

The sequence of the daily routine can be something on the following lines

Early morning If a wet-mash feeding farm, mixing and feeding of the mash at a reasonably early time should be over about 8 30 to 9 a m (Greenfeed and ingredients to be ready previous day) Checking chickens in rearing season

If dry-mash or all-mash feeding, a check around in the morning to see hoppers are satisfactory—top up if required, and check waterers

Morning Egg collection and a general eye on the farm when collecting Follow with any tasks such as necessary stock work, culling, checking sheds, packing eggs

After lunch Egg collection again in warm weather Egg packing or any work needed in checking litter, any repairs (or chickens in rearing season)

Late afternoon Egg collection and packing Feeding grain? Cutting greenfeed?

Evening A final check-up needed in the breeding season with the young stock (and occasionally around the adult stock to see that all is in order)

A night inspection can show up crowding, or housing faults, lack of ventilation, birds roosting in the wrong places, broodies missed and so on

Week-ends At the week-end do not carry out any more work than really necessary. This means attention to feeding and egg collection only (and attention to the growing stock in the rearing season). Other tasks like cleaning, stock work, and vermin control should be carried out during the week on a well-planned farm. Egg packing can be carried out on the Monday as a general rule It is normal to expect things to be easier at the week-end, hence essential routine tasks only can be the rule.

THE TIME FACTOR

DAILY TASKS FOR 1500 TO 2000 LAYERS ON A WELL-LAID-OUT INTENSIVE-TYPE FARM WITH AUTOMATIC WATERING

Approximate average daily time	*hours*		*Approximate percentage of time*	
Egg collection—twice or three times daily according to weather	1¼ *	4	16	= 50
Egg packing and grading for winter and summer	2¾		34	
Feeding of mash (*average* for wet mash or dry mash) and grain (or all mash)	1¾		22	
Checking waterers, culling, checking litter, roosts, odd jobs, and maintenance	1 to 1¼		12½	
Greenfeed, watering and cutting with established crops .	¾ to 1		12½	
Recording work	¼		3	
Approx	8 daily		100	

Approximate time for week = 56 hours Adjustments can be made for less feeding time with all mash feeding and whether greenfeed is grown or not These items could account for variation of from 1 to 1½ hours daily or up to 10 hours weekly reduction Alternatively if a suitable complete prepared ration was used incorporating greenfeed in dry form, and was handled in bulk, time saved could be nearly 2 hours daily or 14 hours weekly This could mean the handling of possibly 500 more layers and the returns for 2500 birds could be assessed against 2000 birds with savings for greenfeed and farm-mixing practice for feed, *or* advantage taken of an easier routine.

* The time taken for eggs is the big factor. Suitable improvements in location of nests, manner of collection (as dealt with elsewhere) can reduce this, but not materially below this figure. If labour can be employed of suitable type at a reasonable cost to cover egg packing and grading in particular (to save this work for the farmer) it can be seen from study of the times of various operations that 3000 birds could be handled on a farm with this extra labour, but this would not be the number per labour unit. It could involve possibly 1¼ to 1½ units of labour.

LABOUR INVOLVED REARING PULLETS WITH A GOOD BROODER AND RANGE-REARING SET-UP

Approximate daily time during rearing season	*Total time taken*
Attention to brooders cleaning, feeding and watering for eight weeks	ap 1 hour = approx 64 hours in 2 months
Attention to stock in rearing quarters for five months feeding, cleaning (water automatic), vaccinations	ap 1½ hours = approx 210 hours in 5 months
	Total time = approx 274 hours

This means with young stock a total time of 274 hours spread over six months (one month overlap brooders and range or intensive-rearing quarters) or approximately 10 to 11 hours per week for this period

TABLE 18

REMINDERS FOR OPERATIONS OVER THE YEAR (AUSTRALIA)
(Some of these reminders will apply to all types of poultry plants)

Month	*Routine tasks*	*Some special tasks for the month*
July	General daily tasks of feeding, egg collection Routine check for culls and vermin Checking litter or cleaning work Greenfeed attention?	Check brooding equipment (and chickens and breeders if on hand) Plant any shrubs or trees required for shelter, windbreaks, and general improvement of appearance
August	General tasks as above (Check egg and cull price trends—possible heavy culling may pay?)	Handling chickens (and breeders if handled on farm) Check space for chickens
September	General tasks as above—do not neglect because chickens on hand	Handling chickens and growing stock Attention to these tasks decides the returns for the following year (Planting lucerne?)
October	General tasks as above (more attention to egg cooling probably needed)	Handling chickens and growing stock Deworming and fowl pox vaccinations for attention if early-hatched chickens Cull any poor doers among chickens—any breeding pens should be broken up?
November	General tasks as above Close check for culls (Watch egg collection for quality) Check for red mites and lice	Clean up brooding equipment Consider tick vaccination if in an area where trouble may occur Check sheds to see if waterers, sprays, ventilation doors and floor shutters in readiness for a heatwave

TABLE 18—*continued*

Month	*Routine tasks*	*Some special tasks for the month*
December	General tasks as above Cull hard—on early moulters in particular Watch for vermin, keep eggs cool, watch out for 'broodies"	Be ready for heat-wave conditions—first really hot day often occurs in December (Clearing up of deworming and vaccination programme with later-hatched chickens) July hatched chickens to laying-quarters?
January	General tasks as above Special attention to egg collection and culling	Check young stock on range (or in intensive quarters) Ample water and shade should be provided and avoid overcrowding Cull as necessary with young stock (Surplus lucerne stored as chaff or lucerne meal?)
February	General tasks as above Heavy culling—watch egg quality	Major portion of spring-hatched stock mature enough for laying quarters Blood testing arrangements for consideration if fertile egg sales or breeding work carried out on farm? Maintenance work on general plant?
March	General tasks as above Completion of heavy culling Handle new pullets in sheds carefully	Spring-hatched stock in quarters by end of month Do not overcrowd—watch for colds? Balance of maintenance programme (doors, egg boxes, shed roofs for checking) Any new building work before early rains?
April	General tasks as above Pay special attention to feeding and house conditions (Production more difficult during this period)	*Clear up any general maintenance or* cleaning work on rearing equipment (Put any portable equipment from rearing range under cover) A good month to "batten down the hatches" on the sheds ready for winter
May	General routine tasks (Care with stock pays dividends during this period)	If breeding work on plant check re matings Keep quarters for the laying stock as snug as possible but well ventilated for winter conditions.
June	General tasks as above	General preparations for the chicken season (Check records for year re production figures, and general expenses and returns on plant?)

(Intensive rearing methods would involve the least labour) This means for half the year, when combining work for layers and young stock, from 46 to 56 hours with hens, and 10 to 11 hours with young stock, 56 to 67 hours weekly, and for the other half of the year layers only. On this basis average time for the full year would be about 50, and up to 60 hours weekly for farm labour according to farm lay-out, feeding system, and general efficiency.

Note Allowance must always be made for the inevitable hold ups [illegible] occur on a farm due to a breakdown in the schedule of operati[illegible] [illegible]r example a break in a portion of the machinery—the mash mixer, the feed cutter—or trouble in the water pumping system wet weather interfer[illegible]ing with outside operations, disease problems, all involve lost time [illegible] well to keep this in mind, because no programme with livestock ever [illegible] exactly "according to plan year in and year out"

CULLING

This is one of the important efficiency moves on a farm The culling of birds is a task that should be kept in mind at all times, but at least make a complete monthly check on the farm for any birds off colour and then handle them (In single battery cages culling is more or less automatic as the egg scores will tell the tale and in small pens it is relatively easy to pick an "off colour" bird, but in large pens a knowledge of culling technique and careful observation are essential)

There is a tendency among many operators to let well enough alone while production is reasonable, and then do a big culling at the end of the laying period This can mean that up to 20 per cent (or much higher in some cases) of birds could be carried as passengers, and at high feed prices this is a heavy burden

COST OF CULLS IN A PEN

With feed at $2 60 per bird per year or 5c per week, and eggs at 35c per dozen a pullet laying at the rate of 15 dozen per year would give a gross return of 10c per week If a cull is present also using 5c worth of feed a week, then two birds show no profit at all So if 20 per cent culls are in a pen or on a farm 40 per cent of the birds return no profit at all to the operator—hence only 60 per cent of the birds would be profitable layers This shows the vital necessity of clearing culls from the farm Make it a job at least one day a month (Remember also that, on the "bird levy" basis, every cull removed does not have to be paid for) The closer it gets to December, when with spring-hatched chickens the poor-grade stock show up as "early moulters", the more emphasis should be laid on this task (Refer to *Fig 151*) It may be possible for a cull sold in December to return as much as a good bird will show in laying profit for January-March and then be sold on a lower market It should also be remembered that efficient culling reduces the likelihood of disease spread—it is a quick means of isolating any birds off colour

EQUIPMENT FOR CULLING—AND COUNTING STOCK

The equipment for culling need not be elaborate

A catching hook A very essential piece of equipment for this work is a catching hook to catch a bird by the leg various operators prefer different types, but a length of No 8 wire $2\frac{1}{2}$ to 3 feet attached by wire binding or cleats to the end of a piece of light broom handle 2 to $2\frac{1}{2}$ feet long is very suitable The wire is bent about 3 inches at the end, and the hook should be able to fit around the index finger A hook made of wire only is too

flexible—it needs the solid portion as well (it could be light tubing if desired) Practice will enable birds to be picked without unduly disturbing the rest of the pen, and without breaking the leg of the bird It is difficult to pick the leg of a bird by "jabbing" at it—it is necessary to use sweeping strokes in line with the direction in which the bird is moving (these could be termed "backhand" and "forehand" strokes) A few catching hooks should be left at convenient points around the farm—this assists culling If it is too far to go for a "hook" one may not bother to pick out a bird noticed, and it may not be thought of again for days

A catching crate It is necessary to have suitable crates to hold birds (these should be of sizes as suitable for market—refer to Chapter 18 on Table-Poultry Production—allow $\frac{1}{2}$ square foot per hen) These fit on a handcart (or the farm runabout or utility) A crate 4 feet by $2\frac{1}{2}$ feet by 15 to 18 inches high will hold twenty birds

Hurdles for culling and catching It is advisable to have a few portable hurdles on the farm These should be 4 to 5 feet high and 6 feet long constructed of light timber framing and 2-inch-mesh netting (3-inch by 1-inch softwood is suitable) Two would be the minimum, but three are desirable A small trap-door 1 foot by 1 foot—3 feet from the ground—is handy on one of the hurdles for passing birds through It is necessary to have two operators when using the hurdles for culling in a large pen, which is where these are needed (a hook only will do in a small pen) The birds are driven quietly into a corner, and then the hurdles moved round to form a temporary enclosure The corners can be held with wire hoops or thin rope (or can be hinged, but it can be rather rough use on hinges at times) This technique can also be used when the birds are wanted for vaccination or blood testing

HURDLES HELP IN COUNTING STOCK—AN IMPORTANT EFFICIENCY MOVE

Hurdles are also handy for counting birds if one cannot count accurately by running the birds "in line" Always make it a rule to count the pens for accurate feeding, particularly if daily feed distribution systems used (Another method is to count by torchlight) Many birds are overfed and others underfed because of neglect of this point (where mash and grain are given) If keeping a check on numbers do not forget that a door left open can mean birds getting through and upsetting pen numbers Also remember that the question of feed is not the only factor—a pen can be overcrowded owing to mistakes of this nature, and results adversely affected even though free-choice feed is available

WHEN TO CULL

A culling of mature birds in the months of April to May would be rather useless It would be normal practice for good birds to be in a moult then and look quite miserable in cold weather—with a score of 250 eggs or more recorded for the year Many good birds have been lost because culling has been left until the end of the year Culling is to be carried out during the laying year, and this will ensure that only the best are left if

this is carried out properly. The cull is the bird out of production for a matter of weeks at the period when birds should be laying Young stock when growing need culling for backward, poorly developed birds, as these will not be expected to be payable

The marketing situation for cull birds (as mentioned before) can also be an incentive for heavy culling. Conversely, if culls are a low price only obvious birds may be removed, but irrespective of the price received a non-producer must be culled out to save feed (and levy also?)

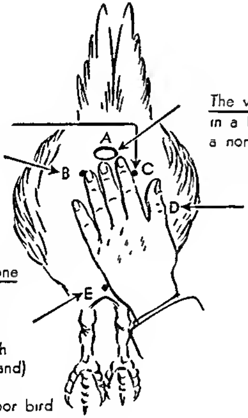


Fig. 159 Points to look for when culling. (See also Table 19)

PRICES FOR CULLED BIRDS

The aim in selling culls is naturally to get as much as possible, and if they will cover the cost of raising young stock it is a very good proposition. In general, returns fall short of this, as a culled hen is not a quality product like a young "broiler". However, this is entirely dependent upon the market. The calculations for costs on a farm have been based on losing 30c to 40c. per bird on cost of raising a pullet, but in many cases operators with favourable connections in dressed-poultry trade have improved considerably on these figures The question of the time to sell has been discussed previously—it is sound practice to watch the market in this respect The quantity of meat to be sold is very considerable on a commercial poultry unit A 2000-bird plant with 75 per cent pullets would sell over 3 tons of poultry meat (live weight) per year, hence 5c a pound could mean a difference of over $300 per year.

HOW TO IDENTIFY CULLS

A bird with the general appearance of loose feathers, dull feather condition, and a shrunken lifeless comb can be culled on sight (culling "on the hoof")

TABLE 19

CHARACTERISTICS OF THE GOOD LAYER AND THE CULL

Points for checking	*The good layer in production*	*The cull not laying*
Comb	Soft, bright red	Shrunken, pale and rough
Face	Bright eyed, clean, and alert	Dull eyed, coarse, heavy, dull
Vent (A)	Moist	Dry
Pelvic bones (B and C)	About two inches apart (three finger-widths), thin and pliable	About three quarters of an inch apart (one finger-width), thick and hard
Abdomen (D and E)	Enlarged and soft and deep (a hand's width between pelvic bones and keel) (about 4 inches)	Hard, flat, and contracted and lacking depth between pelvic bones and keel
Skin	Soft and loose	Rough and tight
Moulting features	Good late moulter about March—worn, rough feathers, bright comb, bare behind comb ('leather heads') Moults rapidly, drops all feathers at once and still looks rough after moult Lays some eggs in moult	Moults early about December-January—ceases laying entirely Moults very slowly Feathers come through gradually over long period Get rid of these as soon as noticed—will not lay again for a long time
Pigment (an important point) (Note A E refers to *Fig 159*)	Period of lay for colour to fade Vent colour—after two weeks laying (possible lay 7—8 eggs) Beak—after six to eight weeks (possible lay 20—25 eggs) Legs—after six to eight months (possible lay 90—140 eggs) (Colour returns in three or four weeks to beak and about three months to legs after laying ceases)	A bird showing colour in the beak after three months is a poor layer, and leg colour showing in a bird eight to nine months after laying maturity indicates a poor layer

Note A good layer is a good feeder, and many operators pick out culls by torchlight at night, picking the birds with empty crops and putting them aside for check-up This works well (Some assist process by giving an extra grain feed before carrying it out Not needed when all mash used)

PREVENTING CULLS IS THE BEST PRACTICE

It is of vital importance to keep the percentage of culls as low as possible This starts right from the breeding pen Proven stock should be used Then the question of adequate room in rearing sheds combined with sufficient good clean range (used only once a year and if possible once in two years) is another factor Overcrowding in intensive-rearing units has a similar effect When in the laying-sheds and particularly in large pens many culls are made by the operator through inconsiderate feeding—not enough food available, and insufficient space, so that some birds are knocked back and soon become culls Overcrowding on the roosts and the floor of the shed also takes its toll It all adds up to good husbandry with proven practices to prevent culls

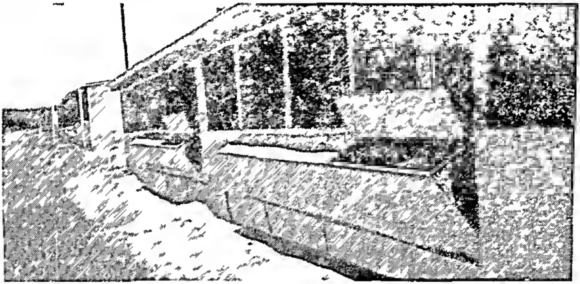


Fig 160 Long feeders built in front of a large poultry shed They can be filled easily with dry mash or all mash from a hand or power truck, reducing to a minimum the labour and time for feeding operations Ample length of feeding space is important to prevent overcrowding and give best results

Mortality is tied up with this factor—the costs have been dealt with elsewhere—as a reminder do not forget 10 per cent chicken mortality means about ½c dozen on costs and 10 per cent adult mortality about 1½c dozen on costs—a total of 2c per dozen Prevention is by the methods mentioned above and in the various husbandry chapters

Conclusion The vital importance of culling to keep costs down has been stressed and it must be a regular part of monthly work, but prevent it being needed as much as possible by good husbandry

MECHANICAL EQUIPMENT

Mechanical aids can be a big factor in reducing labour on the farm Power-driven machinery is essential on the large farm if mixing of feed is carried out (Reference has been made in Chapter 14) A power-driven motor mower or greenfeed cutter can be a big factor in reducing labour if handling greenfeed (Where large lawns are used for greenfeed supply, a

full-sized mower with catcher gives the greenfeed ready to feed to the stock without chaffing and thus saves considerably on labour) A power-driven pump will probably be necessary where water is not laid on A small electric or motor-driven runabout on the farm (or the farm utility) can save a great deal of labour in distribution of feed to the birds, collection of eggs, and also the movement of stock is made much easier This can be a marked efficiency factor on the commercial plant This is also a help for the cleaning of sheds A mono-rail system or a mechanical loader can be a big factor for reducing labour with cleaning work Rotary hoes are employed on some larger units for greenfeed areas or stirring litter (The farm lay-out—referred to elsewhere—should be planned so that a vehicle can be taken along between sheds to save work in loading and unloading) Mechanical feeders have been successfully used on very large plants—this represents considerable capital investment, also the necessity to be proficient in the maintenance of this type of equipment It is best adapted to deep sheds Careful planning can reduce feeding to a very reasonable level with hoppers or troughs set out conveniently along the front of pens that are shallow in depth—20 feet or under (See also Appendix 6)

EFFICIENCY FINDINGS

1953-4 SURVEY OF POULTRY INDUSTRY BY BUREAU OF AGRICULTURAL ECONOMICS, DEPARTMENT OF COMMERCE AND AGRICULTURE, CANBERRA

Twelve farms were selected by the Bureau officers from the 123 random sample farms investigated throughout Australia with over 1000 layers and fewer than 10 per cent sidelines These farms (comprising 10 per cent of the total) gave excellent results The average laying was 14 55 dozen (175 eggs per bird) with 63 per cent pullets on the farms (the top farm was 16 87 dozen) This meant that the pullets on these units averaged well over 200 eggs (approximately 17 dozen) per head This compared with a general average for all farms of 12 16 dozen, on which the pullet percentage was about the same figure Ten of the 12 selected farms had crossbred flocks The labour cost was quoted as 22 per cent lower on the selected farms than the general average of all farms The number of layers per selected farm averaged 2252 compared with the general average of 1822 birds High producing farms call for good equipment and the investment figure for land, improvements, and plant was much higher than for the average of farms (livestock valued at same figure for all farms) The valuation quoted was $11,690 for the 12 selected farms including livestock, but excluding the house on the property This was compared with the average of all farms of $9,538, also exclusive of house

The selected farms were at a high-efficiency level They indicated that the top-level producers in Australia compared favourably with other countries (Reference has been made elsewhere to this point, and authorities quoted, and since that period considerable progress in rate of lay per bird and in handling efficiency has been made) The farms selected by the Bureau were of high efficiency, but some improvements could have been

made in techniques of management and farm lay-out to comply with general recommendations of the Poultry Industry Efficiency Conference held in Perth during November 1954 (These recommendations formed the basis of the established proven practices of poultry husbandry as advocated by various State Departments of Agriculture and the C S I R O Poultry Research Centre These proven practices are the basis of a number of the suggestions given in this book)

BREEDS AND PULLET PERCENTAGE IN RELATION TO EFFICIENCY

The subject of the various breeds and the high-level performance of crossbreds is discussed in Chapter 5 The breeding of crossbreds is based on well-bred pure-breds, and the extensive breeding work on crossbreds being carried out at the C S I R O Poultry Research Centre is referred to

The results of all the farms sampled in the 1953-4 Field Survey of the Poultry Industry by the Bureau of Agricultural Economics have been set out in one section relating to the breeds or crossbreds used on the farms, and the percentage of pullets These are listed by the Bureau as follows

TABLE 20

COMPARATIVE EFFICIENCY OF BREEDS

	100% crossbreds	*60 99% crossbreds*	*Less than 60% crossbreds*	*100% White Leghorns*	*Other breeds*
No of farms	32	23	30	23	15
Yield per layer (doz)	13 42	12 06	11 60	11 09	13 59
Pullet percentage	64	66	65	54	68

The figures presented show the high-level average performance of the crossbred farms, and also the high-level production of the farms in other breeds, which were principally Australorps (in Queensland) The effect of a lower pullet percentage is also shown with the White Leghorns, where only just over 50 per cent pullets were kept as compared with approximately 66 per cent pullets on the rest of the farms

Table 19 stresses the effect of a high pullet percentage in increasing lay

TABLE 21

PERCENTAGE OF PULLETS IN FLOCK

	Less than 50%	*50-76%*	*76% and over*
No of farms	21	76	26
Yield per layer (dozen)	11 23	11 97	13 75

When the Bureau compared flocks of fewer than 50 per cent pullets with farms of more than 75 per cent pullets, the production was 22 per cent greater on farms of more than 75 per cent pullets (Reference can be made to Chapter 7 for further illustrations of the effect of high pullet percentage)

EXTRACTS FROM CONCLUSIONS OF BUREAU OF AGRICULTURAL ECONOMICS 1953-4 SURVEY

The extracts quoted are those covering technical practices on the farms

The major factors that influenced egg-production costs were stated as follows

Yield per layer The range in yield was from 7 to 16 dozen eggs with an average of 12 16 dozen

Several reasons were given for the wide variation in yield, such as the quality of the breeding stock, unbalanced diet, insufficient food, or the inability of some birds to convert a large volume of food into eggs The Survey showed that flocks with a high proportion of crossbred birds had above average yields and the highest profits Only one quarter of the flocks had 100 per cent crossbreds, while more than half of the farms had less than 60 per cent crossbreds This suggests that there may be further scope for the introduction of crossbreds into commercial farms

Flocks with a high percentage of pullets had the highest yields One-fifth of the survey farms had more than 75 per cent pullets Their yield was 1 8 dozen above the group with 50 to 75 per cent pullets and 2 5 dozen above the group with fewer than 50 per cent pullets The cost per layer was highest in the all pullet flocks, but the highest yield resulted in larger profits per farm

As it is generally recommended that the proportion of pullets in a flock should be at least two thirds, the results indicate that it would be profitable for many farmers to reduce the number of the second-season layers carried

Generally farms with the highest yields culled throughout the year

Evidence showed that some farmers paid insufficient attention to correctly balanced rations

It is evident that on many farms a reduction in grain costs could be made This would refer mainly to seasonal opportunities, when substitute grains were actually cheaper on a food-equivalent basis

There is a general preference by producers to purchase mash ingredients and undertake mixing on the farm The supply of ingredients has been variable, with mash manufacturers taking an increasing proportion of available stocks Many producers are paying high prices in order to obtain supplies for farm mixing, and the stage is approaching where the use of manufactured mashes may be more profitable than the use of farm mixed mashes

Labour There is considerable scope for improvement in the lay-out of poultry-farms High labour costs were generally associated with badly planned farms

At the Perth Poultry Efficiency Conference it was agreed that with

efficient lay-out and management a standard of 2000 layers per labour unit could be obtained

Flock size The average flock size was 1812 layers plus supporting stock

Although the yield per layer was lower on the larger farms the size of the enterprise and saving in labour, interest depreciation etc , resulted in a much greater computed rate of return on capital

Capitalization The average valuation, including the value of stock, was $5 20 per layer or $9,538 per farm

Final conclusion The survey revealed that there was great scope for reducing costs within the industry by the wider application of proven efficient techniques (Later surveys indicate extensive introduction of the main points as listed and their coverage in the book is listed below)

Note The various chapters of this book cover many of the techniques of proven practices necessary to efficient production and management For information on technical points on the above extracts from the Summary of Conclusions of the Survey by the Bureau of Agricultural Economics reference can be made to the various Chapters as follows

Yield per layer—particulars concerning Breeding and performance of Crossbreds Refer Chapters 5 and 6, and for Feeding refer to Chapter 14

High Percentage of Pullets—refer to examples Chapters 7 and 17

Culling throughout the year—refer to Chapter 17

Balanced Rations, farm mix or purchased feed, and Grain Costs—refer to Chapter 14

Layout of Farms, labour and capital usage—refer to Chapters 4, 12, and 17

PART II

SOME MANAGEMENT FACTORS

AMPLE WATER

The health of birds and their capacity to produce eggs, and also eggs of good size, are based on many things feeding, breeding, and so on, but water, one of the cheapest items of feed to provide, is often given insufficient thought

Effect of Water in Restricted Supply

The body of a bird and the contents of the egg are two thirds water The consumption of water by stock is approximately double the consumption of feed Water controls the ability of the birds to regulate body temperature in weather extremes, and the ability of a bird to handle feed efficiently The higher the laying rate the more water is required by the birds (The growing rate of young stock can be seriously upset by water shortage) Any restriction will have a detrimental effect on body weight within a short period, and affects the general condition of the bird Water can also be used as the medium for the carrying of vitamins A and D_3 and the administering of drugs It has been noted in official tests that birds under

identical conditions of feeding and floor space, and of the same strain, have laid fewer eggs per year when the volume of water available has been less One set of pens had water available in guttering troughs at all times, and in the other pens the birds were watered by drip valves at which they picked to obtain their water The temperature of the water was also higher in hot weather with the drip valves than in the troughs Average results with birds having access to the troughs have consistently been a few eggs ahead of the other groups It is a necessity that all birds should get the water when they want it, the reference to force moulting earlier shows the effect in reducing lay—also note how they congregate around the water trough after mash or grain feeding Adult birds will drink up to four or six gallons daily per hundred with medium temperatures and up to eight gallons in hot weather It should be noted that the needs of laying birds (and chickens) for water are higher with high protein rations

Water Must be Clean and Cool

Water must be kept in a clean condition by flushing the troughs or water system as often as needed This may be once a week in a system outside the shed, or every day or so in a trough inside, which may have litter scratched into it This is one of the routine tasks of vital importance on any farm unit Water in an insanitary condition will not only affect the health of the birds, but also the grade and keeping quality of the eggs (Refer to Chapter 16 on Egg Marketing) It should be a daily task to check on water not only for supply being available, but for its cleanliness It must always be kept as cool as possible in hot weather by means of a suitable situation and ventilation—outside gutterings need shade covers and water must be close to birds if on range—they will not cross hot open ground or jump up to high waterers in hot weather Heavy mortality in stock can be a result Also ample space prevents heat-wave problems Watch "nipple lines" in case water is cut off and not noticed

In cold weather where frosts freeze a water trough at the edge of a shed, some attempt could be made to have the waterer at a different place inside the shed (Some operators have an immersion type heater in the water—as referred to under Housing—but in general in Australia this may not be necessary However, it could be expected to improve results in frosty, low-temperature weather)

Quality of Water

The quality of the water is important Where normal reservoir water or rain-water is used quarter to half per cent of salt is added to the total feed given Where bore water is used it is advisable to leave out salt, as too high a level is not needed, and the litter of the shed will be difficult to keep dry, since the droppings will be very loose and wet (as with the feeding of rations with high levels of bran or fibre) This condition arises when one per cent of salt is exceeded The tolerance of hens to a high percentage of salts in bore water is surprising when birds are raised on such water, but poultry brought from other water to water with a high level of grains per gallon will suffer a setback A reference on this question is contained in Bulletin 369, "South Australian Natural Waters for Farm

Livestock", by W J Spafford, a former Director of Agriculture in whic reference is made to extensive investigations by V G Heller at Oklahoma Agricultural Experiment Station "The Effect of Saline and Alkaline Waters on Domestic Animals" It was reported that with laying hens normal growth and maintenance was not interfered with until concentration reached 1 5 per cent (1050 grains per gallon), that calcium chloride i not as well tolerated as sodium chloride, and that magnesium sulphate is tolerated surprisingly well even up to 1 5 per cent The general recommendation given is that water containing up to 700 grains per gallon total soluble salts appear safe once the birds have become accustomed to the water The usual standard stated as adopted for "good" stock water is up to 300 grains per gallon, and "fair' stock water containing 300 to 600 grains, with the proviso that when large amounts of magnesia are present the standard be modified This indicates that poultry can tolerate a fairly high level of salt (but young chickens should not be given other than good water) If possible keep it down to "good stock water" level, *and* when 100 grains level reached, delete all salt addition in feed

Water Supply Must be Automatic for Efficiency

This is one of the first moves for efficiency with poultry farming The daily quantity of water that will need carrying per 1000 birds could be over a quarter of a ton, and that means a lot of work It is heaviest when the weather is hot, when the operator has sufficient tasks without this heavy work Water can be made to flow to the points required, and the only requirement is piping and the necessary water valve to maintain a constant level in a trough or a water vessel If water is not laid on, it means pumping the water to a tank or point high enough to give pressure for reticulation Iron piping and plastic piping are both used for the purpose This will eliminate a major task of routine, which otherwise occurs every day in the year The only requirement is then a routine flush of the system and checking valves, but make it a rule when collecting eggs automatically to ' cast an eye" on the water trough to see if it is full Blockages can occur in any system—so do not leave checking for cleaning occasions only Many unexpected drops in production in a shed have been due to water cut off and not noticed—and the birds take some time to return to production (according to the time of the year) Also, place the water vessel on a grill or with an overflow pipe that will operate if the system floods—as will sometimes occur There are few things quite as exasperating and upsetting to set routine as the finding of a pen with a flooded floor due to neglect of planning an outlet for overflow water, thus requiring a complete 'clean out' to avoid possible trouble with the stock

These are the main points in relation to the vital importance of a clean, cool, constant water supply for poultry

The following are important points in relation to water supply control

1 *Sufficient space is essential at the waterer* A six foot side space per 100 birds should be allowed and trough kept full automatically—100 birds cannot drink at a small opening Owing to the reduction of intake of water, egg production falls Also vices such as picking and cannibalism can start up The need for space applies particularly in hot weather

2. *Birds under intensive conditions.* Temperature conditions have a marked influence on water consumption, and consequent egg production. Egg production will drop to a marked degree if water is hot. It is essential that it be as cool as possible and easily available under shaded conditions. To prevent wet litter the waterer can be placed outside the shed on a grille so that the birds drink in what is in effect a small shelter attached to the shed. (See *Fig. 161.*) If water is outside the shed and birds drink through an opening a cover must be provided.

3. *Birds running on range.* The waterer should be located adjacent to natural shelter or close to the poultry shed and must be shaded. Digestive disorders, mortality in heat-waves, and low production will be obtained unless this is done. Birds will not walk to water over an unshaded area in hot weather. It is advisable to have more than one water point with range conditions—one at the shed (for when laying) and at other points on range by or under suitable shelter.

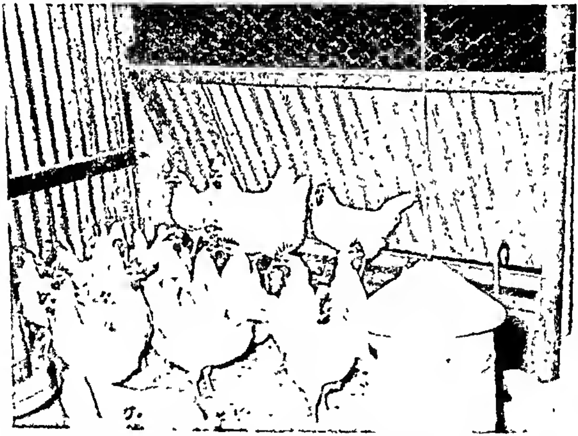


Fig. 161. Automatic waterer, a piece of guttering closed at the ends, has interesting features. Water, supplied by low pressure valve on right, maintains a set level in the trough. Trough is set on wires. All spillage falls outside the shed. Hanging feeder is also shown, with lid to prevent birds getting into feeder.

HANDLING POULTRY IN HOT WEATHER

Reference has been made under Housing Adult Poultry, Chapter 12, to the necessity of correct shed construction to maintain as even a temperature as possible. Control measures have been referred to in Diseases section. It is stressed again that the precautions of·

VALUE OF STOCK KNOWLEDGE

The ability to know the requirements of and consideration for stock is essential to success A laying bird is nervous and excitable, and for this reason certain practices should be observed Some of these are as follows

1 Move quietly in a shed to avoid birds flying about and injuring themselves

2 Wearing the same coloured clothing and making the same sort of noise, for example whistling or knocking against a door, and avoiding waving bags or banging buckets is very helpful to maintaining quiet in the poultry pens

3 If you feed wet mash do not stint feed with only enough for 15 minutes feeding some can be left in an hour, but if after two or three hours some is still left then reduce the quantity Poultry must have a sufficient level of feed If feeding all mash or dry mash do not let it become stale—birds do not like the residue in the bottom of a hopper Feed should be stirred up occasionally and replenished as needed

4 Do not be over-zealous in dosing birds when they are laying well—if droppings are slightly off-colour (owing possibly to weather change or a different brand of meatmeal) do not immediately give a heavy dosing for worms—production will be upset unnecessarily

5 Develop the habit of looking for the off-colour bird in the pen—this is a big factor in culling (referred to earlier in this chapter)

6 Do not bring pullets from the range until they are well grown They settle down better, and less trouble with vices occurs Have sufficient rearing space on a farm so that the pullets do not have to be broken down by moving in too early—start with the full space as for fully grown pullets *if possible* particularly with intensive rearing

7 When birds are what is sometimes termed "talking", it usually indicates that they are laying well and in a contented condition

8 Another reminder on "overcrowding"—this must be avoided at all stages if stock are to perform well, as stressed previously It is always well to remember that when pens are overcrowded the birds have a tendency to reduce the numbers to what they should be by higher mortality, and the remaining birds are never as good because of the effect of the early crowding This applies to rearing either on range or intensively

These points mean quite a lot in getting the utmost from birds Quick changes in diet are strongly resented by laying birds, and this also applies to the consideration shown by an attendant, particularly when young pullets are coming into lay The layers on a unit will usually show what measure of consideration in relation to the same routine is being observed—by their behaviour and their production

AVOID ABRUPT CHANGES IN FEEDING OR HANDLING

Poultry are creatures of habit in relation to where they lay, where they roost, and so on They strongly resent any abrupt changes in environment and with feeding in particular When layers are producing well for the period of the year they must have the same type of ration provided to maintain their laying A sudden alteration in feeding, due to shortage of supplies or a decision to "try a new system" can cause a heavy drop in production If this is done during the "off" period of the year it can cause a large percentage of the birds to go into a moult and then they are not likely to return to production for a long period An abrupt change during September would get away with only a minor setback (almost any feeding and housing method with young or old birds will give reasonably good production in the springtime—efficiency is decided by the number of eggs laid during the "off" or difficult period)

Some types of abrupt changes that will cause these upsets are

1 A sudden change from morning mash to grain only.

2 Changing from wet-mash to dry mash or pellets or vice versa

3 Changing the grain feed to another type of grain (partly or completely)

4 Water-supplies suddenly cut off for a day (or more) (The remedy is obvious here)

5 Changing a mash of bran and pollard to all crushed grains

6 Closing birds up after being allowed to run on range constantly—or stopping a daily run out on range to which birds have been accustomed

How to Prevent the Effect of Changes

Endeavour to keep a month ahead of food supplies This means that if mash ingredients of a certain type or a particular grain are suddenly unprocurable there is sufficient time to change over properly. This is carried out by making a change-over gradually by adding a little more each day, and reducing the other ingredient in proportion For example, changing bran and pollard to crushed grains—add about 10 per cent more each day of crushed grain and reduce bran and pollard by 10 per cent (and add another 1 per cent meatmeal daily to adjust protein in this case) If changing from wheat to oats and wheat 50-50, take about seven to ten days for the change-over The rule for all alterations is that the birds must be gradually accustomed to any changes These points are some of the reasons why ready-mixed feeds are becoming popular as regular practice on poultry units

CONTROL OF RATS ON THE FARM

Considerable losses are caused on poultry units by rats They can destroy growing chickens up to seven or eight weeks old, so make it a rule to make chicken sheds rat-proof This will involve close-fitting doors and bird-netting against openings in the roof coupled with a very good floor.

Rats can spread disease in any section, but particularly in the incubation and brooding sections of a poultry unit The feed loss can be very great—in several sections of a farm Spoilage and waste can occur in the feed shed Feed can be wasted in the laying-sheds where free-choice or dry-mash feeding is in operation Rats can also cause considerable worry to birds when roosting—also to birds in battery cages Loss of sleep for birds does not help obtain good production figures

METHODS BY WHICH RAT MENACE CAN BE CONTROLLED

1 Do not leave feed about in bags or allow piles of bags to accumulate Use bulk bins or silos for storing feed to avoid attracting the rats (If bags are held on hand use in rotation—oldest first—to avoid both stale feed and making harbours for rats) Silos or bins are a very sound investment in this respect (as well as for buying on the best market—refer to Feeding)

2 Do not leave piles of rubbish about the farm—or dead birds Rats will soon devour a carcass, and it encourages their presence, and increases danger of disease spread

3 Use feed hoppers which can be closed off as required, or are set up so that it is difficult for rats to get at them

4 Proprietary poisons are available today, which give a high degree of control Some are in the form of biscuits, others are mixed with the food Some can only be used occasionally, but one or two types can be used all the time as the rats keep coming back to the poison mixture (Put in containers with small entry hole for rats—*but* birds cannot get at it) Phosphorus preparations must be used with care for fear of fires

5 Other methods are gas cartridges for the holes of the rats, rat "hunts" by flooding them out for dispatch by sticks or dogs Cats or good dogs can be very helpful in the control of rats, also trapping helps in the fight

These are some of the general measures for control—but prevention is a great asset, and a considerable saving is made by ensuring the food supplies are held in safe storage

Note Some causes of losses of food not due to rats can be brought about by sparrows and similar birds Cases have been seen where they take a very keen interest in grain hoppers in particular They do not worry all mash mixtures to the same extent Large numbers of these birds can account for quite a lot of feed They have proved so troublesome in some areas that half- to three quarter-inch mesh netting has been placed in the front of the sheds by some poultry men

RANDOM POINTS ON POULTRY VERMIN, BROODINESS, HATCHING, AND REARING

CONTROL OF VERMIN IN POULTRY SHEDS IMPORTANT

Heavy losses are caused on many poultry units by vermin infesting birds, roosts, and sheds Reference has been made to these and their control in the chapter on Diseases A reminder is given here because the efficiency of a plant will be greatly lowered if these are not kept in check

Red mites should always be looked for—periodical turning over of the roosts will indicate whether attention is necessary

Examine a few birds occasionally—or check when culling—to see if any lice are present on the birds, or any stickfast flea.

Do not rely on metal construction sheds or laying cages—check up occasionally Red mites and lice can still be a big problem A neglect of this part of good husbandry can mean a reduced egg lay and more culls and disease problems

BROODINESS AND HOW TO CONTROL

Broodiness can be a worry with floor pens in the warm weather, but if handled correctly the birds can be dealt with in a very short time It is to be expected that heavy breeds and crossbreds will have a percentage of broodiness A broody hen should not be ignored, as some will lay at a high rate after a short spell when handled properly Very high production figures have been recorded by birds that were broody on one or possibly two occasions The compensating factor in a number of cases is that breeds subject to broodiness usually lay well during the high-price winter period. If egg prices during the summer are low some observe the practice of marketing broodies, as noticed on commercial units

METHOD OF HANDLING BROODIES

Broody-coop accommodation should be set at convenient points on the farm—some operators have a broody coop in each large pen These should allow about 2-foot headroom and provide at least 1 square foot per bird in the coop The coop should be subdivided into three or four compartments and the sides can be of wire-netting or slats spaced about 2 inches apart The floor should be composed of 1-inch by 1-inch slats 1 inch apart (netting can be used, but does not have a very long life) Feed and water should be available The idea of three or four compartments is to fill the pens in rotation—if birds are placed in the coop at the first signs of broodiness they will be "cured" and ready to return to the pen within four days The problem does not arise in battery cages, as they are in effect broody coops If broodies are not picked up regularly and become well "set", then it will take much longer to get them over the condition It should be part of egg-collection routine to watch out for broodies (Some have been reasonably successful by placing birds in a small bare shed without nests) This is the method used under present practices to cure broodiness—it cannot be done in a day or by throwing the bird out of the nest into the pen (Future work may indicate the possibility of hormone injections to cure broodiness) One of the best methods of *preventing* broodiness is to see that care is taken with the breeding stock Birds that have not been broody or broody only once should be used This saves time and labour, and egg quality is better in hot weather with a low level of broodiness.

POINTS ON HATCHING AND REARING

1. If a sideline producer is not on electric power and has an inclination to raise stock from a stud breeding viewpoint do not despise the kero-

sene machine, Excellent chickens are hatched when the machine is well The electric machine is the mass production method with la to the minimum, but it does not necessarily produce better c

2. When buying sexed day-old pullets the purchaser is entitled 95 to 98 per cent accuracy This is normally possible with the h qualified chick sexers available in Australia, who have obtained first c (95 per cent accuracy) or special certificates (98 per cent accuracy) (Learning sexing is a costly process involving practice on thousands of chickens before proficiency is attained Two methods are used, the manual by examination of eminences inside the vent, and machine sexing by sighting the organ inside the chicken with a small lighted tube—viewing with an eye-piece) (Refer to Chapter 9 on Incubation) Should results fall below these figures it can increase the cost of pullets by nearly $2 per 100 If this was the case it would not be fair from a buyer's viewpoint This point most hatcheries cover very well, and from the viewpoint of the purchaser a guarantee of 100 per cent pullets (although obtained in many cases) cannot be expected

3 A reminder is given on the question of quality in chickens Do not buy on the basis of chicken day old cost only Quality chickens cost a lot to produce If a strain or cross has a good breeding background, which means a higher percentage of birds capable of efficient feed to eggs ratio, it can pay handsomely to give a premium For example, $6 more per 100 for day-old pullets could show a big gain if they reared well and laid only three to six eggs more per year than another source Results of various competitions and tests indicate a much wider variation in strains than three or six eggs, hence do not be "penny wise and pound foolish" on this important point, and when you have a good source of stock try to hold on to it

SIZE OF LAYERS IS AN EFFICIENCY FACTOR

The size of the bird is a point to be kept in mind on efficiency Layers four to five pounds are big enough to lay full-sized eggs, but are more economical of food and more birds can be placed on a given floor area—thus enabling a lower shed cost per bird and a lower feed cost per bird

HATCHING AND REARING EFFICIENCY OF A STRAIN A BIG COST FACTOR

The number of breeding eggs required to put a well grown pullet into the laying shed is very important If four eggs will put a good pullet into the laying shed it is a very efficient strain and good husbandry has been used If six eggs are taken then a check-up is needed along the line somewhere The four-egg basis needs good hatching and fertility to enable one good pullet to be hatched from every three eggs set This means better than 66 to 70 per cent of eggs set, and after light culling of chickens and 50-50 sexing of day old chickens brings the percentage of eggs set down to 33 per cent per pullets obtained If losses from day old to laying of pullets do not exceed 15 to 18 per cent and a culling of 6 to 9 per cent is

made, this will mean 25 good pullets in the pen from 100 eggs set—or four eggs to a pullet. If six eggs are taken it would probably mean that poor fertility and low hatching (wasting breeding stock, incubator space, and labour) produced only approximately three chickens at day-old. After sexing and removing cockerels, and if losses were in the vicinity of 25 to 50 per cent in rearing and necessary culling, leaving only one pullet, it would mean very poor efficiency and a heavy debit on farm costs. This gives a yardstick. (Some operators (and Random Sample Tests) achieve a three eggs to one pullet placed in the laying quarters basis.)

ADOPTING SAFEGUARDS AGAINST FIRES

A greenfeed area can be a safeguard against bushfires. This point can be kept in mind when picking the area for planting, or make this provision with large lawn space. For convenience of working this can be located near the residence and also as an insurance against fire. (This applies to areas subject to bushfire troubles.) Range-rearing yards can be another safeguard. With normal spring hatching the area is well cleared by the time the warm weather approaches. If this area is set against the outside of the property (and keeping the rearing sheds in towards the inner fence rather than the outer) it makes a most efficient firebreak. A point that should be kept in mind for trouble with fires on the farm is to have a sufficiency of taps with screw nozzles to take a hose (which is normally present on most properties). This can be arranged quite simply by adding an extra tap at convenient points (about 30 to 40 yards apart as a maximum distance—then a 60-foot hose will be effective). It is quite easy when installing an automatic watering system to put the taps in the line. This is an insurance policy in another direction—if the water system gives trouble taps are available at regular intervals for easier filling of troughs by hand, and in a heat-wave the taps are convenient for using a hose for watering down, or filling a knapsack spray without having to go long distances.

These safeguards may not be needed for years, but can be a tremendous help when an emergency arises, hence it is sound to plan a greenfeed or lawn area, range rearing area where this system is used, and location of suitable taps.

SOME NECESSARY PLANT AND IMPROVISATIONS

(More Particularly for Sideline Unit)

TOOLS

IMPROVISED FEEDERS

Some may wish to construct feeders Wet-mash feeding can be out in sawn timber troughs or guttering adapted as feeders Dry or all-mash hoppers call for a better type of hopper but many small (and commercial) operators have constructed hoppers with 44 drums These have been adapted in different ways Some have set the drums at the centre of a large tyre cut in halves (the inner edge would need to be 2 or 3 inches lower than the outer one), and holes are made about 1-inch diameter on the side 2 or 3 inches up from the bottom The picking of the birds at these holes assists feed flow This type may be wasteful

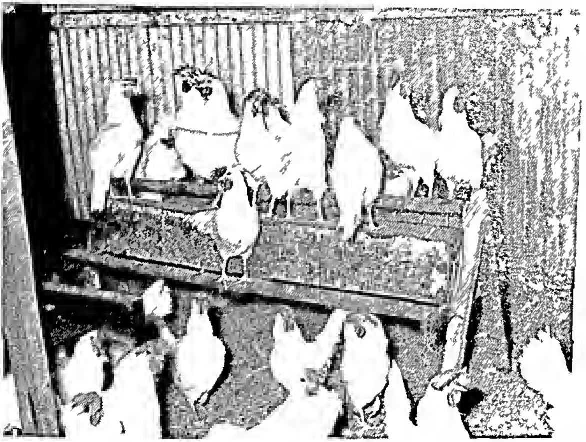


Fig 162 Home made type feeder, set on legs 15 in above litter Centre rail, plus lips at side, prevents spillage of feed Recommended as very efficient and can be made of metal, wood, hardboard or similar materials It is also vermin proof

Another type is made by cutting out the bottom of the drum and sitting the drum up about 2 inches from the bottom of a box with sides about 4 to 6 inches high The box is square and about 2 inches from the edge of the drum at the nearest point (A small triangular piece at each corner to stop birds getting into the box is used) These hoppers are periodically given a shake and are occasionally taken off for the birds to clean the box Others purchase conversion sets with tray, legs and lid from proprietary sources to make the drum feeder Other types of feeders are ordinary box-like feeders about 9-12 inches wide and 7 inches high—length sufficient to give 20 feet space for 100 layers These are usually set up on legs with a

landing rail 4 inches out from the bottom of the trough A single batten 3 inches wide down the centre at the level of the top of the feeder is used—fixed or set to "spin" (with a nail in each end set in a hole to permit free movement) This type is quite successful and does not waste feed—provided it is not filled too full Others are similar in dimensions but of metal with turned edges and wires every 3 inches These improvisations have been used with reasonable success Excellent feeders are available from proprietary sources

IMPROVISED WATERERS

Waterers can be improvised on a sideline unit A tumbler of water inverted in a saucer (with a match to hold one edge up sufficiently for entry of air) makes a good starting drinking vessel for the first few days with a few chickens For chickens up to three or four weeks a very satisfactory type of waterer has been made by sideline farmers with a half gallon flagon turned upside down and held in a cut-off tin of suitable size with slots cut for drinking purposes The tin is cut so that the mouth of the bottle is about one inch from the bottom of the tin (or a small pan can be slipped into this if the bottom should rust) The type has the advantage of the water being seen—supply can be easily watched so that it does not run out

Another type of water trough that has been used on sideline units where open range is employed (and is reasonably satisfactory provided that it is in the shade) is a truck tyre cut or sawn in halves lengthwise along the tread so that it opens up to form two circular troughs These hold water quite well and are quite cheap and suitable used for outside on range under cover

INCINERATOR NECESSARY ON A POULTRY UNIT

An incinerator is necessary on a poultry plant either commercial or sideline A 44 gallon drum can serve quite well on a sideline unit A movable lid is required for the top and the usual opening at the bottom for draught and four or five iron bars to keep the bottom of the drum clear These can be put through the drum about nine inches up (or a grate can be used) This is to prevent the fire being smothered when burning any dead birds (Per 500 birds at least one bird per week can be expected to die when a high level of efficiency of 10 per cent adult loss is maintained) For large units a properly constructed brick incinerator is used (Others have overcome this problem by using a dry well with a covered top) It is an efficiency move to clear all rubbish around a farm and burn up anything not wanted, and do not leave dead birds about It is unsightly and can be a predisposing cause of disease spread

SIDELINE POULTRY POINTS

For Poultry Unit as Sideline for Orchard, Vegetable Garden, or General Farm

The sideline unit has been dealt with in detail in Chapter 4, but one or two points of interest are

Poultry can be handled efficiently on free range in an orchard on a high-level pullet basis by obtaining a full winter period lay and up to the time of the fruit ripening. Birds can then be disposed of to avoid worry with them among the trees and avoid the labour of poultry when fruit picking (and possibly drying) is on. This means a short laying year, but can be an economic proposition when the winter price level is high. The value of manure is also another big factor in these cases. (Reference has been made to this in Chapter 13.) Also, an intensive unit supplying valuable deep litter (an ideal fertilizer) rich in nitrogen, phosphorus, potash, trace elements, and organic matter can be very useful and profitable on a vegetable-growing property.

The poultry unit, when handled on efficient lines with correct husbandry methods and provided it is large enough to be worth while, is a line of production that does not vary from one year to another to the same extent as many lines. Many primary products are dependent upon a favourable rainfall and general weather conditions. The constant-production basis is particularly so with the intensive unit and production can be reasonably level year in and year out. Costs do not vary to a great extent from one district to another, because basic prices for feedstuffs are usually much the same throughout the State, only varying for transport charges as a general rule. This has been a big factor in the adoption of the poultry sideline "sheet anchor" that occupies only a small area, but has been a big item in returns on thousands of general farms in Australia. These represent the major part of the production of eggs here and in other areas.

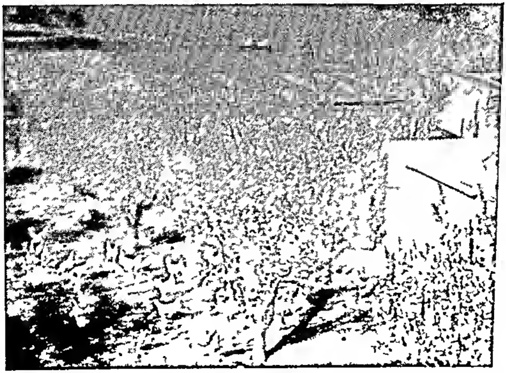


Fig. 163. Poultry housed in semi-intensive sheds set in an orchard. Conditions are good for the birds, and the manuring and working of the ground by the hens improves the returns from the orchard. Efficient sideline units of this type can increase the returns of mixed or general farms without heavy labour requirements. Other units are fully intensive, for full deep-litter value.

The returns for sideline units for 200 or 1000 birds can easily be worked out from examples shown earlier in the book, and in this chapter The examples given for the commercial units can simply be reduced in proportion For example, an efficiency basis for 400 to 500 birds would be a quarter of that set for a full time well-laid-out unit making a figure of 6000 to 7500 dozen eggs per year for this number of layers The investment costs are not as high in proportion as for commercial units The same rules of planning the sheds, egg collection, and feeding should be applied The efficiency of many sideline units is very high—in the Bureau of Agricultural Economics 1953-4 Survey findings it was stated "with the sample analysed for cost confined to commercial farms with restricted sideline production, automatically a significant section of the industry is excluded which could well be relatively more efficient than the average commercial farm as represented in this Survey"

SUMMARY

1 The biggest single factor in efficiency on a poultry unit is the skill of the operator The efficiency with which operations can be carried out, and the time taken, are decided by the planning of the plant and equipment, and the labour-saving features incorporated Various feeding and housing systems have given good returns Assess for most suitable in the locality by using basis given

2 The returns of the commercial unit will be decided by a combination of the following breeding background, number and age of the layers carried, level of winter production obtained, lay-out of plant, and attention to routine tasks The dominant cost factors will be *rate of lay* per bird, *and feed level used* per dozen eggs produced The one man farm in Australia should *market about 25,000 to 30,000 dozen eggs from the least possible number of birds* for efficiency

3 Efficiency practices like the use of a high level of pullets, artificial lighting of large pens, and/or the use of small-pen units or cage systems for high winter-production levels, plus the use of *culling* methods throughout the year, are vital to obtaining the highest possible returns A system of *keeping records* of farm costs and returns is also very necessary Part year production or early heavy culling may pay in some cases

4 Management practices covering water- and feed supply, hot-weather care, diseases and vermin control, good rearing percentages, and care in stock handling are some of the essential parts of a high level of husbandry

5 Poultry sideline units can be efficient both on the basis of production level per bird and numbers handled, and as the balancing factor in raising the returns of a general farm property to an economic level

6 The general efficiency of any plant, whether sideline or commercial, cannot be of a high standard, unless attention is paid to the various factors listed in this and the preceding chapters

Note A reference to the extracts given in the text from the Bureau of Agricultural Economics 1953-4 Survey, will give a lead as to how the

returns of efficient top-line operators exceeded those from other types of farms, with comparable feed costs and egg prices

For further reading on Efficiency Practices, the following references are suggested

Poultry Farm Management Survey 1957-8, 1958-9, and 1959-60, by L E Cozens, D R. Meadly, H A White, Victorian Department of Agriculture Valuable references on highlighting management points needed to increase efficiency.

Poultry Management Study in the Sydney Area of N S W 1957-8, by I Macfarlane, N. S Morrell, Bureau of Agricultural Economics, Canberra, and similar study for 1959-60 by A H Rowe, R Daly, N S Morrell Valuable references on U S A study lines Highlight value of good management, keeping of records and correct use of labour on a comparative analysis basis between various farms

Economic Aspects of Egg Production with particular reference to the Feed Economy, by A H Rowe, Bureau of Agricultural Economics, Canberra A paper presented at 1961 Poultry Nutrition School, Sydney University Valuable leads given from Management Studies N S W , 1957-60 period on input of feed and optimum level ratio for egg output

An Investigation of the Commercial Poultry Industry in the United States of America, 1956, by A G Bollen, A A McArdle, R H Morris, Bureau of Agricultural Economics, Canberra This report highlights features of the U S A. poultry industry which can and are being applied to the Australian industry to increase returns and reduce labour on poultry units

Queensland Department of Agriculture and Stock, Division of Marketing, 1960-1 report on rate of lay for commercial sections in Queensland Weighted average 16 2 dozen This rate of lay compares with any country in an *overall* basis of average production

Part Year Production or Heavy Culling, by A A McArdle, S A Journal of Agriculture, March 1962 Indicates that any decisions on time to dispose of flock or heavy cull must be based on assessing trends of egg prices and cull bird values Also that such practice may pay under some market conditions, particularly with sideline units on grain farms

An Extension Application of Parametric Budgeting in Poultry Management Decisions, by C C Catt, A A McArdle Experimental Record S A Department of Agriculture Vol 1, No 1, 1962 A reference for appraisal of likely part year returns under commercial conditions

Where Poultry Farm Costs Can be Cut, by A A McArdle, S A Journal of Agriculture, April 1962 Highlights Random Sample Tests as lead for cutting mortality costs with rearing and adult stock, also marked savings made by using high energy all mash in place of wet mash practice in these tests

Random Sample Test Reports as issued annually by the various State Departments of Agriculture These give leads on the results of "end product" stock, as purchased by commercial producers, when tested under uniform conditions, and production, feed usage per dozen eggs and mortality possible under good management conditions

CHAPTER 18

TABLE-POULTRY PRODUCTION

THE production of table poultry has now become big business in the Australian poultry industry Its value is estimated at $60,000,000 It has become a major industry on its own It can be a sideline activity, as well as a major commercial operation (Other lines of table-poultry production covering turkeys, ducks, and geese are dealt with in Chapters 19, 20, and 21) Recent trends show increasing interest in this aspect of the poultry industry in Australia, and a better demand for poultry meat The consumption per head of poultry meat had been approximately 10 lb for Australia (but estimates indicate this may now [1965] be 15 to 16 lb per head—a 50% expansion of combined production—*with* the 30,000,000 broilers now being raised) as compared with a figure of approximately 30 lb per head quoted for the United States (Australian red meat consumption is given as over 200 lb per head of population, which is very much in excess of United States red meat consumption This position is primarily governed by the comparative prices for red meat)

Improved techniques to lower production costs and produce good-quality meat to enable expansion of this side of the industry have made possible this steady increase in a few years Major advances have been largely on the lines of adopting practices evolved overseas, particularly in the United States, where the efficiency of poultry-meat production has reached a high level Quite a number of people in the Australian industry have conducted efficient plants, by virtue of initiative in production practices and market contacts A changing trend in the type of table poultry produced for the market has been one of the main measures in achieving lower production costs The marketing of fully grown cockerels at five to six months of age has been largely replaced by the sale of quickly grown young "broilers" marketed at about nine to eleven weeks just before "they really start to eat feed" This has meant a much lower quantity of feed being needed for a given weight of bird or, as it is termed, an efficient feed/meat ratio of food conversion rate This is very important as food comprises 60 to over 70 per cent production costs The young meat birds at this stage have been designated as "chickens" in the United Kingdom, "broilers or "fryers" in United States, and were usually described in Australia as "grillers", but are now usually called "broilers" The quality of the meat with these young "broilers" at this stage, *when* raised on suitable rations, is excellent A big advance has been made in the knowledge of feeding for the special purpose of quick growth of meat and by using what are known as "high-protein" and "high-energy" rations These have been evolved by the efficient use of those foods available in Australia to give a greater gain of flesh per pound of feed consumed than previously obtained This also received a boost by the use of antibiotics as an aid to improving

the food conversion rate with poultry in the early stages of growth This has been coupled with better housing techniques by the use of large scale intensive methods with less effect from weather variations, and reduced labour needed Improved breeding, nutrition and management have been the biggest factors in raising meat-production efficiency *

The major factor is the stock now raised for this specific purpose Some of the crossbreds available have proved very satisfactory Further improvements, as a result of the efforts of interested breeders and research centres have been the production of specialized meat strains, both as complete lines, and male lines for mating with females of egg production lines Industry expansion has been most marked in Queensland, New South Wales and Victoria Very large units, as well as individual growers either operating privately or on "contract" basis for large processing units, operate on U S production lines Mechanized processing on large turnover basis has made possible lower costs, and poultry meat is competitive with many lines of red meat—a necessary basis for further expansion (See pp 11-12)

Note The material covered in this chapter specifically for Australia deals predominantly with husbandry and management features—as suitable special purpose stock is now available through breeding establishments, and proprietary broiler rations of high standard are freely available However, the practices, trials, feeds etc which have evolved to this more advanced stage are given also, for reference in developing areas where some of the similar evolving processes may be undertaken Accordingly each will use those portions of benefit or suited to the particular operation

SUITABLE BREEDS, AND COMBINATIONS OF BREEDS, FOR TABLE PRODUCTION

The raising of poultry breeds in Australia had been predominantly for egg production Concentration upon this in any breed is usually at the expense of body size The main breeds available in Australia for table production, are White Leghorns, Australorps, Rhode Island Reds, Sussex, New Hampshires, Plymouth Rocks and Game birds Most of these breeds have certain features desirable in table birds The practice has been to try to combine these to produce birds that will grow quickly into weighty birds—desirable by 10 to 12 week stage

GAME BIRD CROSSES WITH HEAVY BREEDS

Game birds crossed with heavy breeds produce excellent table birds, but the commercial possibilities are restricted The numbers available in Australia are limited, fertility is not high and growth rates are not fast—all increasing the production cost—and the pullets are poor layers They are better suited for full grown stage marketing Private markets willing to pay the necessary premium for this type of production have been supplied by some operators on a profitable sideline basis Future possibilities are being exploited in this direction with the use of artificial insemination and the use of crossbred cockerels from Game birds crossed with other breeds in turn, thus obtaining better fertility—and hybrid vigour

* It has been stated in the United States that efficiency improvements have been approximately 50 per cent in feeding, 40 per cent in breeding, and 10 per cent in management with table meat raising

RHODE ISLAND REDS AND SUSSEX

These two breeds produce heavyweight cockerels that are high-quality birds at the five- to six-month stage, but they are not the best proposition for the quick-grown stage of three months, as they mature slowly. The Rhode Island Red pullets are good layers, but the Sussex pullets have not reached a high level in Australia in this regard. Experimental work has been carried out with the combination of these two breeds as crossbreds, and the results have been encouraging. The Rhode Island Red male crossed with Sussex females gave the best results in hatchability, rearability, and growth. A feature that is of interest is the sex linkage that occurs when the mating is made in this way (it is more difficult to distinguish in the reverse cross). The pullets are dark-buff to red in colour, and the cockerels white like Sussex chickens at day-old. The colour of the pullet follows the male bird. The crossbred pullets from this cross have given good laying results, and some reports indicate that they perform well under battery laying cage conditions. The cockerels from this cross when fed on ordinary growing rations, which would nowadays be termed "low-energy rations", and hence not as efficient as those now used, reached 6 lb. and over in weight in six months in a trial. This cross is better used for the fully grown stage than the twelve-week marketing stage. The quality of flesh and carcass appearance is excellent from the cross and also from either breed as purebreds. The Sussex male x Rhode Island Red hen cross is the most attractive in this respect, and pure-bred Sussex dress with a very attractive appearance.

AUSTRALORPS

Australorp cockerels are well suited to the fully grown cockerel stage, but mature rather slowly for the three-month stage. The laying of the pullets is excellent, as dealt with elsewhere. The main deterrent to specialization in Australorps on a competitive market is the appearance of the carcass when dressed—the dark skin and legs do not make an attractive display. Weights comparable with the Rhode Island Red can be reached.

WHITE LEGHORNS

White Leghorns have the desirable features of quick growth and fast feathering. They can be grown quickly in the early stages, but are not a good table proposition at the full-grown stage. They have been profitably grown by a number of operators for the early marketing stage. The excellent laying of the pullets has been dealt with elsewhere.

COMBINATIONS FROM THESE BREEDS GIVE GOOD TABLE BIRDS

The production of crossbreds by mating the heavy breeds with the quick-growing White Leghorn has given an ideal griller-type table bird for the quick-grown market at three months or the full-stage period. The crossbred vigour has helped lower costs by giving a high percentage of

rearability and quicker growth (The mortality factor alone can decide the profit margin on a commercial scale) The quick-growth factors of the White Leghorn, combined with the weight features of the heavy breed, have meant a cockerel with desirable weight to enable an efficient food conversion rate The main combinations used with the White Leghorns are the Australorp, Rhode Island Red, Sussex, and New Hampshire breeds Crossbreds are usually credited with making faster growth than purebreds in the first three months with cockerels or pullets

LAYING OF CROSSBRED PULLETS IS A FACTOR IN LOWERING COSTS

The laying of the crossbred pullets has an influence in reducing the production cost of table cockerels The cost of crossbred cockerels can be taken, as an example, at approximately 8c at day-old When high efficiency operates and feed costs 3c per lb , the initial day-old cost is approximately 15 per cent of production costs to twelve-week stage (Itemized costs are given later) (To cover periods when crossbred cockerels are not available, genetic efficiency for growth has been lifted by sound breeding work to enable sale of mixed sex meat chickens The growth rate of both the cockerels and pullets has been improved to make it possible to match crossbred cockerel returns)

Pullets do not give as efficient a conversion rate of feed, as their genetic make-up is for a smaller bird in all breeds than with the cockerels Even if these were cleared (with ordinary egg production line crossbreds) without loss or a small profit margin, it means a higher price on the cockerels—mixed-chicken price could be 15c to 17c (as may apply with meat-strain chickens) This means an increase to 25 to 30 per cent of costs for day-old purchase An increase of 8c per chicken at day-old would equal the cost of 2½ lb of feed at 3c per lb This makes necessary high food conversion efficiency for meat-strain chickens as crossbred cockerels have given better than 3 5 lb of feed used per pound of meat produced at approximately 12-week marketing stage On the basis of average weight obtained of 2¾ lb in one trial with crossbred cockerels this would require a reduction to a conversion rate of 2 5 lb feed to 1 lb of meat This is now possible—see 1965 Random Test results This point has been stressed as an example to show the importance of the day old cost factor in a short-term project such as ten to twelve weeks' production of meat (A much increased cost can be well justified for pullets, which operate over a period of sixteen to eighteen months for growth and laying periods, and a higher output of only a few eggs due to better breeding would justify a higher price The sale of hybrid and strain cross chickens at higher prices in the United States can be quoted as a case in point) The comparison given shows that something can be sacrificed on feed conversion efficiency if picked up on purchase costs The prices are low in Australia for reasonably efficient cockerels They are available on this basis for part-year period owing to the pullets being good layers and thus finding a separate market They are the logical starting point for developing areas Results of the recent Random Sample Meat Tests in New South Wales (1962-5) indicate that various meat lines have approached economic parity with crossbred cockerels This makes even returns possible over the year—either with these for all periods or in combination with crossbred cockerels

POPULARITY OF VARIOUS CROSSBRED COCKERELS

The greatest number of crossbred cockerels available are from White Leghorns crossed with Australorps The cross is carried out both ways and the excellent laying results of the pullets have been covered earlier in the book The cockerels available from the cross both ways are well suited to the griller or small roaster (or "broiler") trade They present an attractive carcass, clean-legged and clean-skinned (from the cross either way), and combine the characteristics of quick growth and a meaty bird

The White Leghorn with Rhode Island Red cross produces an excellent cockerel, quick-growing with a good frame, clean legs, and a very attractive carcass with particularly good flesh colour, and the pullets are very good layers

The White Leghorn and New Hampshire cross produces a fine quick-growing table bird, also clean-legged with good flesh colour

In view of the demand that exists (as a general rule) for the early-hatched, fully grown crossbred cockerels, most commercial operators tie up on a contract basis in order to obtain regular supplies The availability as required also comes into the picture Pure-breds in these breeds also receive a good demand, particularly from the early hatchings, but these are purchased more for the four-month to six-month trade Finally, we must not forget that a place exists in the quick-grown trade for White Leghorn cockerels (In developing areas, where demand in general for conformation in birds does not apply—and preference is for smaller birds—the crossbred cockerel has considerable appeal and a low cost as a by-product to the crossbred pullet)

To sum up, the crossbred cockerels available are capable of efficient food conversion, and have been the basis for table-poultry production in Australia Supply did not keep pace with the requirements of table-poultry production Breeding efforts have been directed towards producing special meat lines to cover this aspect The aim of lifting the level of a breed or cross to the stage where the pullets approach the present cockerel feed conversion efficiency, with a corresponding lift for the cockerels, has made it possible to pay mixed sex prices for a straightout meat-producing breed This is now normal practice The meat lines have been evolved by using progeny testing of sire lines, combined with mass-selection between the breeds discussed Large scale operations have made possible heavy selection, and consequently fast progress

SYSTEMS FOR EFFICIENT RAISING OF TABLE POULTRY

These are the three main systems suited to raising of table poultry.

1 Intensive rearing in confinement on deep litter—the lowest labour cost and the choice of most operators—pp 471-82

2 Battery or cage rearing (entirely or combined with intensive rearing—pp 482-6)

3 Free-range rearing (entirely or combined with "topping off" in batteries—pp 486 8)

REASONS FOR ADOPTION OF ANY PARTICULAR SYSTEM

The particular type of trade to be catered for, the area of land and capital available, and the skill of the operator are three of the main factors that can decide the system to be adopted as a commercial venture A different approach would possibly be made by the person desiring to raise poultry for table purposes as a sideline to a commercial egg-production farm, or a general mixed farm It must be a rule, as with egg production, to handle enough birds to make it worth while commercially or as a sideline. The basis can be worked out by reference to the examples given with costs and returns later in the chapter

1 INTENSIVE REARING IN CONFINEMENT ON DEEP LITTER

This means the rearing of large numbers of chickens on deep or built-up litter in intensive houses, to the broiler or small roaster stage (being approximately ten to twelve weeks old and with weights per bird, under good management, averaging about 3 lb or over) The actual growth is not necessarily more than in batteries, but the saving of labour is the big factor in reducing costs, as many more chickens can be handled by one operator than with any other system Requirements for space, ventilation, and feeding must not be neglected, as the whole success of the venture can hinge on these Controllable features such as coccidiosis, fowl-pox, or blackhead (refer to Diseases section for control) can wipe out the profit margin on a batch entirely, so the rules laid down must be observed carefully Overseas and local authorities concur on the point that management is responsible for the success or failure of this type of rearing—excellent stock and high-energy rations will not make good birds if they are neglected, overcrowded, and kept under insanitary conditions This system is definitely the most popular intensive method by virtue of capital required and low labour requirements for the raising of chickens to griller or "broiler" stage

GENERAL RECOMMENDATIONS

Certain general rules must apply to the growing of young table birds with this system, irrespective of the number handled in each lot The general basis is as follows

Sufficient Floor Space

Make 1¼ square feet available per "griller" to twelve weeks if possible (and not under 1 square foot) A general recommendation is nearly 1 square foot per bird to nine or ten weeks—and some operators have got down to as fine as ¾ square foot at some seasons of the year Such factors as good feeding and drugs to control disease (e g coccidiostats) have enabled this space to be used, but maximum growth cannot be attained with less than 1 square foot per bird under normal conditions Also allowance must be made for weather extremes Trials have shown an increase in weight of over ⅛ lb per bird with a higher quality carcass when

rearing on the same feed with birds given $1\frac{1}{4}$ square feet as against $\frac{3}{4}$ square foot per bird, and a slight increase with over 1 square foot per bird. This is worth while, as with the same feed/weight ratio for both birds (pounds of feed to get one pound of meat) and with the decreased mortality (about 2 per cent) and better-quality meat, it gives the equivalent of nearly two broilers extra raised in every twenty-five without extra cost. These things mean money, besides avoiding the risks of disease due to overcrowding. It is also easier to cope with the correct litter condition needed and shed-ventilation problems, so do not go under 1 to $1\frac{1}{4}$ square foot per bird for twelve weeks. This would mean from 640 to 800 broilers per pen area of 20 feet by 40 feet. (*Note:* If carrying stock to sixteen weeks reduce to 350 to 400 for a shed 20 feet by 40 feet for thirteen weeks to sixteen weeks.) It is most important that operators allow full space recommended.

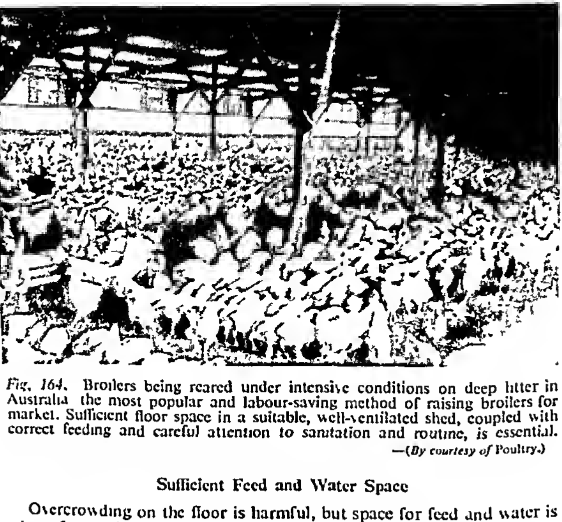


Fig. 164. Broilers being reared under intensive conditions on deep litter in Australia the most popular and labour-saving method of raising broilers for market. Sufficient floor space in a suitable, well-ventilated shed, coupled with correct feeding and careful attention to sanitation and routine, is essential. —(*By courtesy of* Poultry.)

Sufficient Feed and Water Space

Overcrowding on the floor is harmful, but space for feed and water is also a factor vital for good growth and avoidance of vices such as feather-picking and cannibalism. These can follow overcrowding in any manner, particularly with big numbers. Provide 4 feet (one side only) space for feed and one drinking fountain for water up to four weeks per hundred chickens. From four weeks to twelve weeks provide 12 to 15 feet per 100 (one side only) or a 5-foot feeder available both sides for 60 to 75 for feed space and maintain one water vessel per 100. Use of 5-foot feeders enables better

distribution of feed * Alternatively for the water have a water trough running through the shed (with a wire grill to prevent birds getting into it) Troughs of this type should give 2 to 3 feet of space per 100 chickens Set on a wire or similar type platform to prevent damp areas around the water. Wires through which the birds drink to be $1\frac{1}{4}$ inches apart to four weeks and $1\frac{3}{4}$ inches to twelve weeks If shallow V-type troughs only 1 to $1\frac{1}{2}$ inches deep, wires are not needed This type does not present litter problems due to spillage Water-supply should be automatically controlled (refer to Chapter 10 for general handling of water and feed) Conversion rates are influenced to a marked degree by feed and water space

Feed Requirements

Use the high-energy ration shown in this chapter as a basis—or purchase from proprietary firms This is made available at all times up to nine weeks (up to 25 per cent grain should be fed in addition from seven weeks until marketed or crushed grain added to the feed) Hard-grit can be made available or included in ration Avoid costly waste by using feeders with turned edges, wire guards, and do not overfill the feeders—two-thirds is sufficient

Litter Control

For complete information on deep-litter handling refer to Chapter 13 The high-energy ration used (with crushed grains as the major portion) will give the lowest quantity of droppings possible with a feed, and this is a big help to dry-litter conditions As with any all-mash system, there is no incentive to work the litter (also cockerels are less inclined to scratch than pullets), hence stir the litter frequently to keep it in good condition (A popular litter is shavings and sawdust) Opinions differ on whether new litter should be started with each broiler lot It is suggested as the safest rule that new litter be started with each lot, although in warm weather success with good rearing and low coccidiosis level has been reported with the continual use of the litter for chickens to this stage In this case it is usual to rake off the rough material and add some fresh litter on top There is no objection to raising cockerels on the litter used for rearing pullets on an intensive farm where cockerels are raised as a sideline Some operators using litter continuously put it up in a heap between batches This assists by the heating caused destroying the eggs of worms and coccidia At all times, if the litter is used continuously, put some fresh litter on top where cockerels are first brooded (strong fumes can give them a bad start—and sore eyes) Earth floors can be used quite well with the deep litter (see Chapter 13) provided floor-level is above surrounding ground level Note the instructions re using hydrated lime (or superphosphate) at the rate of 1 lb to 6 or 8 square feet of floor space for drying out litter, when it has a tendency to dampness, but exercise care in view of the "closeness" of chickens to litter compared with hens The rule must be to maintain the litter in a loose, friable condition and keep it dry

* The use of round hoppers (diameter about 18 in) suspended from roof—one to each 60 to 75 chickens to 8 weeks, and one to 50 thereafter—can save frequent replenishing of feed as with troughs These are raised as chickens grow

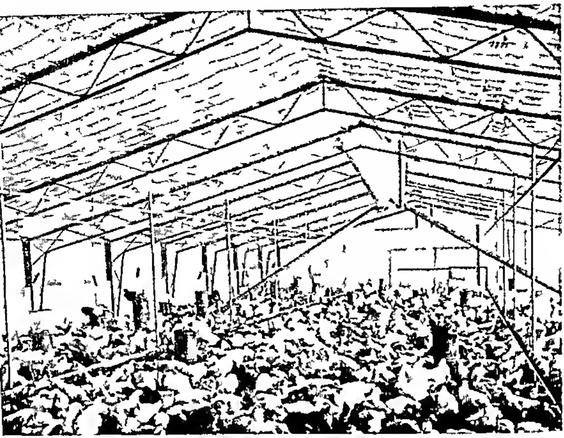


Fig 165 A large griller or broiler type shed with gable construction Automatic feeder is shown also hanging feeders and feed line supply from bulk feeder Overhead lighting is installed Reinforced aluminium foil insulation is set under roof of shed

Brooding—and Management Points

The same recommendations in relation to handling temperatures apply in all respects as outlined in Chapter 10 The necessary information is given to cover the handling of infra red, electric hover, gas or hot water pipe, and large kerosene hover brooders for units of up to 1000 chickens in one lot The same rule of ½ square foot per chicken for the first four weeks must be observed for all these types of brooders and also ample heat at all times (It is however very much better if possible to start with space that they will finish with) Smaller numbers can be handled per brooder (350 to 400) by working three in a room sufficiently large for the 1000, with individual guards or divisions surrounding each unit These can be removed after eight to ten days, and chickens can mingle, but are more or less trained to the brooders In this system the use of intermediate weaning off heat stage is dispensed with to save labour, by leaving the brooders on as required until about six weeks—use the chickens as the guide Watch for cold changes Roosts are not usually used with this system although some operators use them at the end of the house with a ramp running to the roosts, which have netting underneath as a precaution against 'packing up dangers The general practice is to raise grillers without roosts Avoid creating panics—always move quietly in the shed—adopt the same type of clothes—do not wave bags—make the same kind

of sound on approaching the shed Also it is important to keep *some lights* burning *all night* and particularly when 1000 or more together to save panic and possible heavy losses * These are all-important rules in keeping young stock contented This is a vital factor in good growth—the careful, considerate attendant regularly on the job with feeders and waterers kept right gets better and bigger birds for the table (also, environmental control of shed temperatures has potential with broiler raising)

Ventilation

Ventilation should be as set out for the brooder stage in Chapter 10 After the six-week stage the cockerels can usually have the front (or side ground shutters) of the shed nearly half open under Australian conditions For the warmer periods similar requirements to adult- and rearing-sheds are needed —the ventilation shutter at the back of the shed about 6 or up to 12 inches wide just under the roof plus shutters at near ground-level for additional ventilation for raising grillers For each 10 ft length of shed provide a 6 ft by 2 ft shutter at back and front (or sides) of shed To be set 1 foot above floor level and hinged at top edge 3 feet above floor To open outwards Wire netting in opening Keep these shutters half open from 6 to 8 week period, and fully open in heat-waves (See *Fig* 166)

Summer Conditions

Difficulty will be experienced with growth during these months, as it takes longer to bring birds to maturity and every week extra costs money Cool areas have an advantage Sheds adequately opened up will be a big help Another practice that gives a boost for the summer period is the provision of artificial lighting A lower rating than for laying hens can be used (see below) (Chickens respond to red light Some operators claim red light use gives quieter birds, better growth and control of vices Blue light the reverse—can make night catching easy) During all periods these should be used throughout the night to promote feeding, particularly in hot weather, *and* to avoid heavy losses due to possible panics Artificial light pays Increased growth is also obtained in batteries by the same provision Suitable roofing material is also a big help in summer, e g asbestos *or* insulation under the roof (See *Fig* 165)

Grillers per Shed

The simple design types of sheds mentioned in Chapters 10, 11, and 12 are suitable for the raising of grillers (or broilers) *See also special type in Appendix 2* Suitable sheds are also available from proprietary sources Opinions vary considerably as to the number to be handled per pen The restrictions that apply are those that cover the raising of all stock, namely overcrowding causing variability in size and increasing the likelihood of disease problems ("Nature does not like crowds ") Overseas practice varies considerably in numbers of broilers in one lot—from 500 up to 2000 The larger the number together, the greater the responsibility of the operator. However, in the large groups with an even distribution of brooders, feeders, water, and night lighting the tendency to crowd in one spot is controlled to a high degree, but better growth is obtained in small groups

* Three 25-watt incandescent lamps are sufficient for a pen of 1000

Care of Grillers in Heat-waves*

Under Australian conditions, very large batches of September-hatched well-fattened grillers or broilers just about ready to market in mid-December, and a temperature of well over 100°F. being experienced, could mean the loss of hundreds of birds with heat prostration This can be avoided with openings near the roof and at ground-level with the sheds, a light dampening of the litter as necessary, and mist sprays with/or a sprinkler on the roof of the shed. Sufficient floor space is important, *and* ample water and feed space also These moves, if coupled with insulation under roof, can cope with heat waves.

Fig 166 A medium size griller or broiler unit in Queensland Roof is lean-to type Floor-type shutters give ample ventilation This design of a high shed and aluminium roofing to reflect heat, makes for efficient results

Suitable Sheds for Raising Grillers

(*a*) A shed 20 feet by 20 feet† as used for 100 laying birds intensively could be used for raising 300 to 400 grillers Raising in these size batches gives excellent growth The alteration necessary would be to enclose the front half-open portion for the first few weeks with glass cloth or some similar preparation The brooder heating may have to be watched carefully

* Grillers usually reach a given weight approximately one or two weeks earlier under cool conditions in winter than with summer heat

† These types of sheds have been worked with slatted sides in hot areas with ½-inch gaps and 3-inch timbers or slats These break the wind and are cool in summer.

when used from day-old stage (extra heat should be provided), if no roof insulation in the shed, for example five infra-red lamps at start instead of four (*and* with a hover), or a 500-size hover brooder, and ample surround or guard of sufficient height (2 feet) in the early stages Another plan could be the use of a special shed for brooding and then transferring at about a month—with a similar brooder set up as a follow-on (or a weaner type adaptation) The one shed right through is best For handling methods refer to Chapter 10 Check provision for floor level shutters (See p. 475)

(*b*) A lean-to shed 60 feet by 20 feet (as described on pp 225-7 for 400 adult birds handled as one unit under reasonable rainfall conditions) could be adapted to comfortably handle 900 to 1000 grillers or broilers The roosting portion, which is separated by a division wall, is adapted as for (*a*) as the brooder room (20 feet by 20 feet) For the early brooding stage it can be used with ten infra-red lamps or a large hover type brooder —electric or kerosene This inner space is quite ample for the first month, because by the time the chickens have reached three weeks they are allowed to run out in the remainder of the shed (area 40 feet by 20 feet) They are restricted to a small portion of the outer shed for a few days until they become used to the area The usual handling methods are used (refer to Chapter 10) be careful to start with at least three to four inches of chaff or sawdust (or other materials) as litter in the inner portion Check for ground shutters as on pp 475-6 when using this laying shed for grillers. (This type is suitable for egg *or* meat production)

(*c*) The practice of raising cockerels in very large numbers brooded under the same roof is frequently carried out in gable type buildings, unlined (except for possible insulation under the roof), under Australian conditions Asbestos is very suitable roofing material and can be used for walls also (many other normal building materials also suitable) The outer walls should be at least 6 feet high for convenient working, and the gable can rise to approximately 12 feet The ends and sides can be of closed construction but windows can be allowed about every 4 feet and can be approximately 3 feet by 3 feet and in addition hinged shutters* 18 to 24 inches wide at sides nearly at ground level are recommended The best way to swing the windows is at the centre, so that when opened they swing inwards at the top, and if unexpected rain is experienced it does not wet the litter, as the window area is protected If necessary to protect against cats with netting, then hinge the windows at the top to swing out The windows should be high up—about 3 feet to the bottom of the window *Ample windows,* plus the doors and *ground shutters,* will ensure adequate ventilation at all seasons—ample fresh air is vital for "grillers" The ends of the shed should have a very large doorway in each—possibly 9 to 10 feet wide and 6 to 8 feet high—either a slide door or two hinged doors This is very helpful in hot weather for ample ventilation and also is used for ease of cleaning out

* These shutters can be hinged at the top to allow them to swing out, but cover for rain in case weather changes Netting inside is necessary to keep the chickens in and also protect them For dimensions see p 475

with a vehicle, also catching the birds In this type of shed brooders can be set out at intervals or the long pipe system along a wall (or close by) or radiant heat can be used The brooders are surrounded by guards for the first week or ten days, and then the whole floor area is made available

The required number of feeders and waterers as listed earlier should be allowed These should be spaced out at even intervals around the area. The long water trough running the length of the shed against the wall is well suited to this continuous type shed, but 6- or 8-foot waterers can be evenly spaced out quite successfully The usual procedure (listed earlier) re stirring of litter frequently should be followed and feeding should be based on the ration set out in this chapter (or suitable proprietary feeds used, which comply basically with these recommendations) To keep a shed of this type working at capacity, a brooder shed half the size and used in conjunction can work well (or it can be an extension of the shed) It would enable overlapping, for example, 2000 chickens in a brooder shed could be ready at nearly a month old, just as grown birds were being passed out for market Sheds of this type can be from 20 to 30 feet wide (or up to 40 feet) and up to 60 feet and more in length A shed 40 feet by 60 feet could handle 2000 grillers Sizes can be adjusted to suit—height to about 3½ to 4 feet An idea which is *necessary and accepted practice* to avoid trouble with chickens piling up (always move carefully to avoid frightening chickens in big lots) is to have partitions in long sheds A 40-foot wide shed would be broken at each 50 foot mark by a division across the shed This area 40 ft x 50 ft would hold 1600 to 2000 in each pen Divisions are of light timber and netting, with a door for communication, and are removable for cleaning and for catching birds (*See shed design of this type in Appendix 2* pp 667-70 Shutters can replace 2 ft walls)

(*d*) *Some management points* Lighting is necessary in houses of this type Use as referred to earlier under summer conditions—that is, lights on all night The numbers of chickens to be handled at one time may possibly be restricted by the availability of supply, as 3000 or 4000 chickens in one consignment is a big order for even a large hatchery, when a particular cross may be wanted Single operators can handle up to 7500 to 12,500 at a time on plants with good equipment and lay-out Check a few chickens every week to see if they are making near the weights shown on the chart in this chapter If outbreaks of feather-picking occur, refer to Diseases section for control methods—either suitable feed alterations or debeaking Little extras, apart from careful treatment in the shed, which pay dividends are putting fresh feed in or on the hoppers Do not overfill troughs or hoppers—half full to two-thirds is essential to save waste Feeding some fresh feed daily is good practice to promote interest and occupation (as with the stirring of the litter) Mechanical feeders can be used, but are costly to install and service, but save handling of feed inside the shed The habit of moving among the birds is worth while, and they can be checked for any signs of trouble developing For these reasons, and also investment costs, many efficient operators in Australia use the ordinary troughs or hanging feeders (These must be raised as chickens grow for feed economy)

Mortality

The success or failure of the intensive-rearing system (and the others also) can be decided by the mortality question The figures given under the costs and returns examples in this chapter indicate this, and mortality should be kept under 10 per cent if possible, and not be over 15 per cent Good chickens are essential in the first place—no one can rear poorly hatched chickens from stock with pullorum disease Another few pence per chicken can be well worth while if they have the stamina and the ability to grow quickly Handling the smaller lots (under 1000) will pay by virtue of better growth and low mortality—after all one extra division door to go through does not mean much with automatic water, all-mash feed available, and deep litter Disease factors are controlled, including respiratory problems, by a clear break to spell sheds between batches Coccidiosis can be a problem With a high-level milk powder percentage in the feed and dry conditions with ample room, this can be controlled Feeds containing a suitable coccidiostat are used to a great extent with meat chickens today on a preventive basis with successful results, but care should be taken not to rely upon this, and observe care in handling, or other troubles will follow This is no real substitute for careful husbandry Feather-picking or cannibalism can be responsible for losses and affects the appearance of the carcass If this develops in spite of good husbandry it can be easily controlled by debeaking (methods referred to in Diseases section) at any stage from day-old—usually from three to seven weeks and also toe-clipping Electric debeaking machines or small clippers are used

Note It is stressed that the general basis should be to use the smaller numbers in batches This reduces the possibility of disease and gives more even and better growth

Cost of an Intensive Plant

A cost basis for the sheds and brooding equipment with prices as shown in Chapter 3 (also some details are given in Chapter 4) could be as follows (Adjustment can easily be made for higher or lower costs per 100 super feet of timber or per ton of iron and so on)

Refer to Farm "D" shown per 1000 layers on all-intensive basis This has costs listed at $3700 without house, land, or labour erection costs (plant taken as erected by the poultryman and an area of half an acre would do for land) This covers sheds listed for laying and rearing purposes, with a floor area of approximately 5000 square feet The sheds can be 80 feet by 20 feet or 60 feet by 20 feet This total space could accommodate 4000 to 5000 broilers at one time Details of sheds are given in Chapter 12, and these sheds are suitable for griller rearing The brooding requirements would mean some additional closing up Owing to the sheds being used for rearing to twelve weeks, one-third of the space would need to be used for hot brooding, or 1500 to 2000 capacity The allowance in the plan was for 500 being reared at a time The saving on "egg room" material could cover the increased brooder cost The brooder cost was set

REFERENCE CHART FOR GRILLER CARE (DEEP LITTER)

Period	*Number of chickens per brooder*	*Floor space in each pen from day old to marketing*	*Brooder temperatures*	*Room temperature and light*	*Feed hopper space*	*Waterers*	*Humidity and ventilation*	*Management of litter*
Day old to one week .	Depends on type of brooder Refer Chapter 10—use guard for 3-5 days	1½ square feet per chicken.	90° to 95° (at edge of hover 1 inch above litter) Refer Chapter 10	About 65° to 70° and night light on	Use high energy griller ration Can use cardboard lids for 4 days Then use small feeders.	1 waterer per 100 chickens, 1 gallon size Chickens not to travel far to water About 8 feet only	65% desirable air in room to smell "sweet" and fresh	Use ample good clean dry non-slippery litter. Stir daily.
One to 4 weeks .. .		1½ square feet per chicken.	Watch chickens. Should spread out in circle. Reduce temperature about 5° weekly.	Keep pilot light burning at night to avoid "panics".	Use small feeders till 10-14 days, then larger or hanging feeders — 2 to 3 to each 100 chickens according size.	3 feet of water space per 100 birds.	Increase ventilation to keep air and litter in good condition.	Stir litter daily (no roosts used for grillers).
4 weeks to marketing (10-12 weeks) .. .		1½ square feet per chicken (1½ square feet better for last 2 or 3 weeks if possible)	Harden off heat, according to weather.	Natural temperatures in normal weather. (Keep pilot lights burning.)	Raise feeders gradually. Keep feeding edge about level with neck of chickens	At least 3 feet space for 100 grillers.	Increase ventilation to keep air and litter in good condition.	Keep litter dry, sufficiently deep and *well stirred*.

at only $80, but for 2000 capacity this could mean with infra-red brooders, or kerosene hovers, about $120 to $150, which would not alter costs very much. If other types such as gas or battery brooders were used for the first stage it could mean about $350 to $700 with costs in between for various other types. Hence an overall figure could be $4000 for plant and material (without labour for building plant, house required, or land) This cost (approximately $1.00 per griller capacity) would be increased with gable-type sheds, although if a large shed is used the saving on divisions can be a factor. A general basis, if 100 per cent increase for contract erection and giving full space of 1¼ sq. ft. per bird would be approximately $2 00 per griller capacity. Successful results are obtained with the 20-foot-deep type sheds, both here and in the United States This cost of $4000 could apply for a plant that could handle 4000 to 5000 at one time, which could be on three or four lots per year basis, an output of 12,000 to 20,000 per year This is on basis of materials—if erection by contract could be $10,000 * If returns made it necessary to handle twice this number—which is possible of attainment—the plant would be doubled in cost.

Operational Schedule

By overlapping the brooding or raising in ten weeks instead of twelve, it is possible to put through four lots (20,000) in a year with this plant, but in view of summer conditions it might be difficult to operate efficiently A possible buying basis at day-old for three batches (allowing about 15 per cent mortality) if trying to sell lots of 4000 to 5000 grillers—presuming available in this number at same time—is suggested † Early June—6000 to clear early September, and straight on with mid-September 6000 to clear mid-December (just before Christmas) A break at this period (recreation?, and also chickens in this month do not grow well—would also give a chance to spell and overhaul plant) then early February 6000 to clear during May. If trying to run almost continuously with four lots of 4000 to 5000 it could mean: first lot early July to clear early October, but second lot started in an extra brooder room in September to clear December (overlapping four weeks). A short break, then third lot end of January to clear end of April (providing growth is satisfactory) and fourth lot end of March (started four weeks early in the extra brooder room as with September lot) to market end of June—running a close schedule, but possible with extra brooder space. If chickens can be marketed at 10 weeks of age, then purchase every 11-12 weeks This gives time to clean out between each lot. In this case extra brooder space would not be needed, and 4 runs would be possible. (Continuous type operations present greater disease carry-over problems and require careful husbandry.)

* A check can be made by costing intensive farm @ $6 per layer at 4 sq ft, hence approx. $2 per griller capacity with 1¼ sq ft

† If these large batches are not available, then instead of a large lot every three months, a continuous type operation could be used with 1500 to 1600 started every month to give the same overall number for the year. This would involve some adjustment with the brooding, as this would be in operation continuously. The sheds would be subdivided with divisions to take about 1200 to 1500 in each, and one pen would be regularly used for brooding to month-old stage. (This may suit needs for a regular market)

Conclusion

These points cover the general basis suggested for efficient intensive rearing on deep or built-up litter with young grillers or broilers to ten- or twelve-week stage The likely returns and costs are dealt with later in the chapter, also the feeding ration and possible weight gains The general husbandry requirements are covered in the chapters to which reference is made This system is the most popular

2 BATTERY OR CAGE REARING

(entirely or combined with intensive rearing)

Cockerels can be successfully raised in a small area, with very little trouble from disease, and good carcasses and flesh quality in battery cages right through to marketing This is possible by means of:

1 Four weeks in ordinary battery brooders
2 Three weeks in "follow-on" weaners or cold batteries (*or* 8 weeks in these through to market stage)
3 Five to nine weeks in battery cages—marketing at twelve or sixteen weeks—the limit suggested for battery raising (Breast-blisters are a problem beyond this stage)

Another method has been to combine raising on the floor for twelve weeks as for the intensive system previously discussed, with topping-up for three or four weeks in batteries or cages (Normal losses for cage rearing practice are rated as for the intensive method—that is, about 12 to 15 per cent, but are frequently less)

COMMENTS ON CAGE REARING AND COMBINATION *SYSTEMS*

The requirements for feeding and water, and the approximate rate of feed consumption are as discussed for the intensive method The only proviso is that where skim milk is available it can be used if wished to mix some of the mash when topping-off in the last stages in cages.

The space requirements for feed and water are also the same Cannibalism would be handled in the same way and it probably will be necessary to debeak This will break out if room temperatures rise above 75°F. to 80°F, and poor ventilation causing humid conditions is another cause Give enough fresh air without draughts Cannibalism is likely under conditions of this nature, mainly owing to lack of occupation—plus the other causes listed As a general rule it is normal practice to debeak birds* and clip the toenails when raising on wire

Brooding in the battery brooder up to four weeks has been covered in detail in Chapter 10 and follow-on brooders for four to seven weeks in Chapter 11 The grillers can be kept in these to 10 or 12 weeks, if

* Debeaking can be carried out as early as day old, but use care at this stage, and debeaking again at later stage will be needed P Smetana, Acting Officer in charge, Poultry Branch, Western Australian Department of Agriculture, indicated at 1962 Field Day that severe debeaking at day old stage could retard growth by 10 per cent (With floor-rearing, it is now usually done at one week)

allowed ½ sq. ft per griller, with good results. Follow-on batteries 2 feet 6 inches by 2 feet 6 inches by 15 inches high per section and containing eight sections—with two per floor—can be used and could hold 13 to 15 per section or 100 to 120 in a complete unit. These can be worked in the same room as the battery brooders and weaners or follow-on batteries.

Artificial lighting, as mentioned for intensive rearing, is also an advantage with this system.

Note: It would not be wise to attempt putting cockerels into big lots on deep litter after being in follow-on brooders. Also start up with fresh litter and be on the look out for coccidiosis if wishing to adopt this practice, as chickens from follow-on brooders are "soft" when they reach the ground. (They have not built up gradual resistance as with the floor-brooder chickens but for cockerels this could be controlled to a large extent with some of the coccidiostats available today.) For general operation it is best to raise either intensively or in cages—combination systems greatly increase handling labour without specific gain.

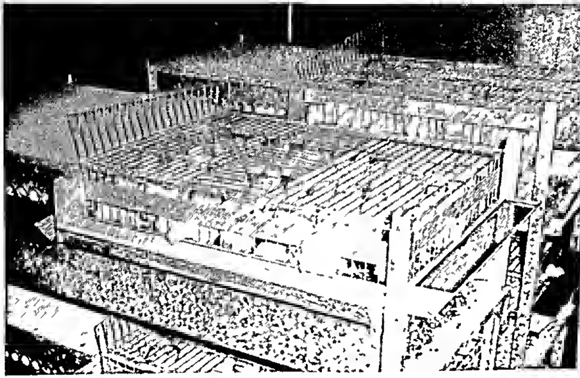


Fig. 167. Battery brooders being used for raising grillers in the hot brooding stage, with a wire floor rearing plant.
—(*By courtesy of* Harrison & Sons.)

BATTERY CAGES USED FROM SIX TO SEVEN WEEKS

(after Follow-on Brooder or Floor Brooder)

There are two different types of cages that can be used for the final period of five to nine weeks (or for three weeks if topping-up from range). These are:

1. Continuous lines of six-cage batteries usually three tiers high. Each cage which is 2 feet 6 inches deep and 2 feet wide and 21 inches high (do not

have them lower than this) will take ten cockerels to 11 weeks, seven cockerels through to fourteen weeks, and approximately five to sixteen weeks. These are worked with dropping trays underneath, which are cleaned as required. Use feed troughs with turned edges and the front edge set high to save waste. (See *Fig. 168.*)

2. Single-tier coops (on the lines of single-tier battery laying cages) when suitably made are used in the open with the floor level set about 3 feet above the ground. The droppings fall through to the ground underneath. Well-drained positions are required for this type. The coop floor can be of 1-inch slats 1 inch apart or heavy gauge wire mesh (1-inch).

Fig. 168. Battery cages under cover in an open-fronted house for rearing grillers or small roasters up to 12 or 16 weeks marketing stage. These cages have floor area of 5 sq. ft per compartment on each tier and are 21" high. Each holds 7 birds to 14 weeks or 5 to 16 weeks.

—(*By courtesy of* Poultry)

These can be made of various dimensions, allowing for 1 square foot per bird to sixteen weeks (or ½ sq. ft. if only taken to 10 or 11 weeks). One size is 8 feet by 3 feet for 25 and built with a height of at least 3 feet 6 inches at back and 4 feet in front (ample headroom is important at all times, particularly in wire cages—it is a factor in reducing breast blisters). The roof needs to be well up in this type to reduce the temperature in hot weather. Also avoid overcrowding—allow the full 1 square foot per bird to sixteen weeks of age. Ample ventilation and preventing overcrowding are the best way to avoid cannibalism, but with birds on wire debeaking and toe-clipping are usually needed as a control. With outdoor coops the sides and back are solid (except for allowing a hinged board just under the

roof for ventilation—about 6 to 8 inches wide should be given—this is needed in hot weather). The roof should overhang about 1 foot or more to protect the pen and the feeders, or set a protecting piece 1 foot wide at an angle of 45 degrees from the roof in front. The sides are carried down to the wire or slat floor-level only so that everything is clear underneath. (A solid area under the coops is a big help for cleaning, and watch for fly problems.) (See *Fig. 169* below.)

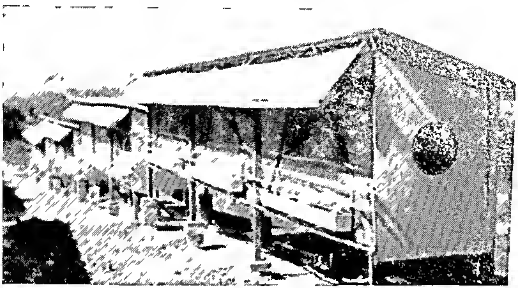


Fig. 169. Outdoor raising units for roasters, where they are held from about 7 weeks of age up to 16 weeks. The units are divided into 3 compartments, each 8′ x 3′, and hold about 25 up to marketing stage. Ample headroom is provided. Cleaning arrangements are simplified with this system as compared with the use of trays.

—*(By courtesy of* Poultry)

PLANT NEEDED

Costs of a battery plant will vary according to the type of batteries used, and also whether the operator can construct a good deal of the equipment. The system does not want to be over-capitalized, but at the same time good equipment is necessary or maintenance will be heavy and results below expectations.

V. H. Brann and F. H. Hart in "Table Poultry", a comprehensive reference Bulletin on meat production issued by the New South Wales Department of Agriculture, listed the following equipment as necessary to raise 5000 cockerels per season, and quoted a cost basis of about $3200 working on 1952 costs,* and a land area of about half an acre.

(*a*) Three four-deck battery brooders.

(*b*) Eight four-deck follow-on cold batteries.

(*c*) Brooder and follow-on room approximately 20 feet by 30 feet.

(*d*) Twenty-six cage-battery units.

(*e*) Battery shelters total area 100 feet by 6 feet.

(*f*) Water installation, working tools, sundry plant.

* Estimate 1962 costs $5000 ($2 per bird capacity; full year gives 10,000 operation). Investment comparable with intensive, but higher depreciation and labour costs.

CHEMICAL CAPONIZING

Chemical caponizing, by injecting the cockerels with one pellet at about eight to ten weeks is worth while under this system, giving slightly increased weight and easier handling It does not show significant gain for 12 week stage, but is used for 14 16 week stage Refer to technique described later in this chapter For latest rulings on use of this practice, check your State Department of Agriculture

GENERAL REVIEW

The battery rearing system is efficient, provided good management is adopted High quality birds can be raised with attractive carcasses The system is capable of being handled on a small area, and many disease factors can be easily controlled Good sanitation is vital for success Labour and depreciation are higher than with floor rearing The birds grow quickly on suitable rations as described in this chapter It is most important that they should not be overcrowded—the ½ sq ft space per griller for 4 to 12 week stage must be given A quick return is possible with this system (as with the intensive system) For the general assessment of likely costs and returns, refer to the examples given later in the chapter

3 FREE-RANGE REARING

(possibly combined with topping off in batteries)

This system is the same as that described for the raising of pullets in Chapters 10 and 11 Where adequate fresh range is available, well grown cockerels can be raised efficiently with a minimum of disease troubles and can be marketed in fine condition A saving of 15 to 20 per cent can be shown on food consumed (as with pullets)—refer to examples later in the chapter The area of land necessary would be approximately 10 acres to raise 5000 cockerels in a season This would be to the 24-week stage, hence would be nearly the equivalent of 10,000 at 12 week stage (Refer to examples of costs and returns later in the chapter) Labour requirements would be higher owing to the greater distances to be covered with an area of ten acres However, with automatic water, and all mash feeding (on the ration basis set out later in the chapter), the system could be handled, if sufficient good land at reasonable price was available within easy transport distance of the market This type of system can be used successfully as a sideline operation Another possibility is that where grillers are being raised, and some extra land is available, they could be transferred to range if the prices were not suitable at twelve week stage This would enable them to be carried on to the prime roaster stage (6 lb or more live weight) and the griller schedule to carry on in the intensive units This could apply if space was insufficient to raise to twenty four weeks intensively

HANDLING METHODS

Brooding (Day-old to Four Weeks)

Handle as described in Chapter 10 for whatever system is used—battery brooders or floor brooders

Follow-on Stage (Four Weeks to Six or Seven Weeks)

Handle as described for Battery Rearing in this chapter in follow units, or transfer direct to range-rearing-sheds using weaning boxes on these sheds (as described in Chapter 11)

Rearing-sheds

Handle in the rearing-sheds as described for pullets on basis of a *maximum* of 500 per acre of land The area to be used only for raising cockerels for one run for the season If desiring to run a second lot through the sheds, make provision for this by having portable rearing sheds and move them to fresh ground This will pay dividends in health and growth rate This would also increase the possible output without extra sheds needed if extra land is available Train the cockerels to each house for few days as set out in Chapter 11

FEEDING

Use the rations set out in this chapter (with ample greenfeed available on range the lucerne meal could be left out) for day-old to twelve weeks and twelve weeks to twenty-four weeks Provide feed in weatherproof hoppers or hoppers against the front of the shed Feed consumption will be 15 to 10 per cent less than under intensive conditions A small percentage of grain (about 20 per cent) should be fed in addition to the mash under good range conditions for the early stage, after the warm brooder, and an increased level for twelve to twenty-four weeks stage as compared with intensive conditions (or feed as for breeders for 12-24 week period)

WATER

Automatic waterers available if possible This is very necessary to keep labour to manageable proportions

FOXES

These can be a big problem on range Close sheds at night and follow general recommendations in Chapter 11

CULLING

As with all systems keep a close eye on the stock and cull poor doers—mentioned here because culls are less easy to see on free range than when closed up in a poultry cage or under intensive conditions

COST OF A FREE-RANGE REARING UNIT

Where a commercial undertaking on this basis is contemplated a possible costing for capital investment for materials could be as follows (exclusive of a house or the labour of erecting the plant)

Possible cost of brooder installation to raise 1000 chickens at one time

(Reference to Chapter 8 shows suggested materials and brooder costs—without building labour)

- $60 for infra-red and $320 for shed for 1000 chickens
  = approximately $400

  or

- $350 for battery brooders for 1000 and $150 for shed
  = approximately $500

Materials for rearing equipment for raising 2000 on free range are shown in Chapter 8, for twenty houses, yards, netting, piping, etc , and three acres of land (the three acres of land valued at $500 in this example), and reference can be made to this chapter The cost is shown at $1700 (on the basis given) For two and a half times this unit for 5000, plus extra $400 for increasing the land from 7½ to 10 acres at approximately the same rate per acre, together with the brooder equipment ($400-$500) the cost would be from $5100 to $5200 The land is valued at $1750 for 10 acres in this figure, hence the actual plant could be $3450 to $3550 (without labour costs for erection)

Note If the houses were made as portable units and the hatchings spread over a longer period possibly 25 per cent of the houses could be saved reducing costs by about $100 This plant could handle 5000 in about eight to nine months or less according to purchase time The necessity to handle larger numbers (for example 10,000) would involve double the outlay and area under this system

LIKELY COSTS AND RETURNS

Refer to Example III later in the chapter for an estimate of likely costs and returns on the basis of the prices given

TOPPING-OFF BIRDS FROM RANGE

Excellent birds can be marketed direct from the range, but if topping-off is carried out it will add weight, and the quality of the flesh can be improved The usual period is three weeks in the cages before marketing Some birds will fret and if they show a loss of appetite after two weeks it is better to market them straight away They can be fed the mash as used outside, but it will be an advantage if some could be given as mash mixed with skim milk Gains of up to 1½ lb per bird have been shown in three weeks in some cases, although if birds are well advanced before entering the coops very much less will be obtained Suitable coops would be the outside type mentioned under Battery Rearing, and allow 1½ square feet per bird in the coop or cage for the twenty one to twenty-four week stage (if topped off for five month sale from seventeen to twenty weeks, then 1¼ square feet per bird will suffice)

GENERAL REVIEW

Handled on the lines set out, and with good pasture, range rearing can be an efficient proposition The sideline raiser of cockerels on a general farm may be interested in this method, or the commercial egg producer in areas where extra land is available at reasonable cost

HIGH-ENERGY RATIONS FOR RAISING POULTRY FOR MEAT

One of the best examples of an early suitable ration for meat raising under Australian conditions was that used in trials at the Poultry Experiment Station, Seven Hills, New South Wales This contained a high level of crushed wheat The work was reported by M. W McDonald, formerly Research Officer, Poultry Experiment Station, Seven Hills, and G I McClymont, formerly Special Veterinary Research Officer, Nutrition Laboratory Veterinary Research Station, Glenfield, New South Wales, in "High Energy Rations based on Crushed Wheat and Meatmeal" (Later Seven Hills rations, with added vitamins, amino acids and minerals, have given improved results See p 498) Another was the ration used for experimental work at the Poultry Research Station in Western Australia This was reported by D K Giles, Western Australian Department of Agriculture, in an article "Producing Poultry Meat for Profit" These trials showed that a high-protein ration containing a high level of crushed grains gave efficient conversion of feed to meat Trials at Parafield Poultry Station, South Australia, during 1958-60 gave good results with early-hatched first cross cockerels raised on the ration given on pp 490-2 Many cockerels exceeded 3 lb live weight at nine weeks, and all averaged 3 3 lb by eleven weeks with 3 36 conversion

The ration as used was based on the N S W and W A work, with minor alterations in levels, and with the addition of antibiotics Field trials have shown its efficiency for growth and feed economy A saving of 25-40 per cent in feed used compared with low energy rations was shown (The levels of substitutes which can be used are shown with the ration, and see note below concerning further additives)

Note Some operators have tried to cut costs in rearing cockerels by using cheaper types of foods Wet brewer's grains have been used These are very high in fibre and could be used as a small percentage if obtainable regularly, but cannot be held very long unless dried The use of stale bread is not efficient with cockerels Economical quick growth with poultry can best be obtained by the use of high energy foods correctly balanced

A HIGH-ENERGY RATION FOR USE FROM DAY-OLD TO 12 WEEKS WITH GRILLERS

Quantity Approximately 100 lb.

This ration is fed without extra shell-grit, grains, or greenfeed being needed Hard-grit can be sprinkled over the mash once per week, or included at ½ to 1 per cent level From eight weeks to twelve weeks add 25 lb and up to 30 lb (in last stages) of crushed wheat to each 100 lb mixture This adjusts the mixture without a separate formula for a finishing ration It is a basic practical ration which has given economical commercial results *It is possible to obtain improved results by adding* synthetic amino acids, e g methionine lysine and further vitamins, e g choline, also fats, as available at economic prices

Ingredient	*By weight*	*By measure*	*Substitutes—in part or completely*
(1) Crushed wheat	47½ lb	Approximately 2¼ 4-gallon buckets	Can substitute with high level of crushed maize—in which case increase mang sulph. to ¾ oz (approx 20 grammes). (Maize will improve the flavour and moisture content of the flesh)
(2) Crushed barley	10 lb.	Approximately ½ 4-gallon bucket.	Crushed wheat or some milo can be substituted.
(3) Meatmeal (50% protein) *or* Meatmeal (50% protein) and Meatmeal (60% protein)	22 lb. 12 lb 8 lb (and 2 lb crushed grain)	Just over ¾ 4-gallon bucket. Nearly ¾ 4-gallon bucket	(*a*) If only 60% meatmeal used reduce to 18 lb. and add 3 lb. bonemeal to maintain phosphorus and calcium level and add 1 lb. crushed grain. *Do not use low protein meatmeal* (40% protein) (*b*) 5 lb peanut meal (good protein) could replace 5 lb of the meatmeal (*c*) 4 lb livermeal and 1 lb crushed grain could with advantage replace 5 lb meatmeal. If other protein meals (e g soya bean meal) used in part adjust for calcium, phosphorus, and fibre. Refer chart given pp 344-5. Alterations as above for (*a*) or (*b*) or (*c*) will improve results appreciably.
(4) Buttermilk or skim milk powder	7 lb.	Nearly ½ 4-gallon bucket.	Can be replaced by 4 lb. whey powder, and 3 lb livermeal without upsetting protein or riboflavin level. This would give higher efficiency. (If replaced by 7 lb. whey powder, and no livermeal* used, add 3½ lb. of 50% protein meatmeal, and reduce crushed wheat by 3 lb)

* Livermeal is a valuable ingredient and a small level is very desirable.

Ingredient	*By weight*	*By measure*	*Substitutes—in part or completely*
(5) Crushed oats	10 lb.	Just over ½ 4-gallon bucket.	Crushed wheat or barley can be substituted, but retain if possible
(6) Lucerne meal	3 lb.	Just over ¼ 4-gallon bucket.	This should be fresh, high-quality lucerne meal and cannot be replaced unless by some fresh greenfeed The quantity necessary would be approximately 1½ 4-gallon buckets for each 100 lb of ration fed, but the lucerne meal should be used if possible (Dehydrated lucerne meal is the highest grade product but good quality meal sun cured can be used)
(7) Salt and manganese sulphate	¼ to ½ lb. salt and ⅜ to ½ oz. of mang. sulphate	1 breakfast cup of manganese and salt.	Normal needs for sodium and chlorine are covered by the salt. The manganese is necessary to adjust the level in all grain rations. Increase to ¾ oz. (20 grammes) if high level of crushed maize included. (Note: Salt could be reduced or deleted. Meatmeal salt content, water quality, or litter condition can be a guide.)
(8) Vitaminized powder (recommended or oil emulsion containing vitamins A and D_3	3 oz. of oil emulsion with 5000A 1000D_3 per gramme level or 1½ oz. of stabilized powder 10,000A and 2000D_3 per gramme.	½ breakfast cup of 5000A 1000D_3 oil emulsion or manufacturer's measure for equivalent level of A and D_3 powder (inclusion of B_2 (riboflavin) with A and D_3 also desirable —see comments p. 493) also p. 494 re advantages of supplement mixtures	This level of vitamin A and D_3 will cover all requirements for intensive rearing. It should not be reduced in view of the high requirements of chickens making rapid growth. The level of the vitamins in the oil emulsion will fall more rapidly when mixed in the mash than with powders, but is safe for at least a week.

Ingredient	*By weight*	*By measure*	*Substitutes—in part or completely*
(9) Antibiotic supplement	$\frac{1}{10}$ gramme to $\frac{1}{2}$ gramme per 100 lb (2 gr to 10 gr per ton) or is fed dissolved in drinking water	Use according to manufacturer's direction Normally mixed with a "spreader" for ease of mixing Mix frequently as potency diminishes when held	Antibiotics stimulate growth in the early stages This is valuable when raising for table purposes It can reduce feed requirements per lb of meat by up to 10% It can improve mortality rates To be discontinued at twelve weeks—no gain is obtained after this stage

Note Crush grains and mix feeds frequently—weekly or fortnightly This will ensure freshness of ingredients and save vitamin losses Crushed grains should not be held for long periods nor should they be crushed fine—coarse crushing is recommended

APPROXIMATE ANALYSIS OF RATION AS SHOWN*

Protein 20 4 per cent to 21 3 per cent
Fat 4 per cent to 4 5 per cent
Fibre Approximately 4 per cent
Calcium 2 3 per cent (with 50% protein meatmeal used—see comments)
Phosphorus 1 7 per cent (with 50% protein meatmeal used—see comments)
Riboflavin 3 7 parts per million (without synthetic addition)
Manganese 65 to 100 parts per million
Vitamin A 4250 units of vitamin A per lb (without any allowance for the lucerne meal)
Vitamin D_3 850 units of vitamin D_3 per lb
Units of Productive Energy (Calories) 850 per lb of the ration
Energy/protein ratio approximately 42/1 for 8 weeks and 48/1 for 8 to 12 weeks finishing period

EXPLANATION AND COMMENTS ON RATION

1 Crushed wheat (or replacement with a portion of crushed maize) is a high-energy food to give quick growth in a suitably balanced ration

2 Crushed barley as a small percentage adds variety to the ration

3 Fifty per cent meatmeal has desirable protein, calcium and phosphorus ratio and at this level in the ration is more than sufficient calcium source Do not feed extra shell-grit The adjustments shown for (*a*) or (*b*)

* The levels of protein, vitamins, calcium, phosphorus manganese, and energy are all sufficient to give adequate margin for safety

or (c) in the ration aid by reducing calcium level, *plus* other useful factor Amino acid supplements may not be needed with high-grade meatmeal of this type combined with the milk powder A low-protein meatmeal will give poor growth with cockerels or pullets, can also be a cause of deficiency complaints due to excess of calcium, and may have toxic properties Results with batches of grillers may vary due to variations in the quality of meatmeals

4 Milk powders (skim milk or buttermilk) are a valuable high level source of riboflavin, and various growth factors. They should not be replaced by synthetics in a ration of this type *but* the use of Vitamin B_2 as an addition is recommended to cover possible deficiencies in lucerne meal, etc Their inclusion at this level covers possibilities of acid deficiencies besides riboflavin They also provide required high-quality protein, balance meatmeal deficiencies, and provide a valuable safeguard against coccidiosis Labour is saved by their inclusion in dry form They are rated as increasing growth by up to 10 per cent

Note Some of the amino acid requirements supplied by the meatmeal and milk powders are methionine (the addition of 1 per cent methionine has improved results), lysine, arginine and so on (See also p 494)

5 Crushed oats, as a small percentage to avoid increasing the fibre level, is a valuable ingredient It also has value as a measure of control against feather-picking Also, some mixture of grains is desirable

6 Good-quality lucerne meal supplies vitamins B_2, E, and K also factors for health and growth as in greenfeed and necessary for growing stock This method of inclusion reduces the labour factor involved with greenfeed and maintains energy level as compared with greenfeed use The possibility of loss of vitamin A is adequately covered by the vitamin A substitute used in addition Should doubt exist as to the lucerne meal quality, synthetic vitamin E to be added at manufacturer's recommended level

7 Salt is necessary as set out in the ration The manganese supplement (when using good-grade commercial powder manganese sulphate) maintains a sufficient level to prevent perosis This level will be adequate (with adjustment for maize as listed) (If the meatmeal or water salt level is high then delete salt or it could be reduced by ½ to ¼ lb)

8. The levels of vitamins A and D_3 are more than adequate to maintain good health These levels cover all recommendations listed for intensive rearing in England and the United States Overseas work indicates the desirability of this higher level of D_3 with the rapid growth of chickens on high-energy antibiotic supplemented feeds The use of a 5 to 1 ratio A to D_3 product covers both levels (The rate of growth is comparable with that listed for turkeys) See comments under 4 for Vitamin B_2

9 Antibiotics have been discussed in Chapter 14 (see pp 328-30) They are used up to twelve weeks, but no gain is obtained with cockerels or pullets beyond this stage The extra growth will level out thereafter. They can be of value in reducing mortality and culls Some tests have given an

increased weight gain of nearly ½ lb of meat in twelve week cockerels with 1 lb of feed less taken A marked response usually occurs with pullets when these are being raised for meat—for example mixed sex chickens in the high protein meatmeal used as in 3 (*a*) under ingredients, and 1 per cent methionine added, *has given better than 3 to 1 conversion and birds over 3 lb weight at 10 weeks with meat strain chickens*

THE QUESTION OF ADDITIONAL SUPPLEMENTS

Other supplements are now used in Australia for improving the feed/meat conversion ratio with the raising of table chickens (and also turkeys) Some of these include

1 A percentage of added animal fat to the ration for "broilers" and also turkeys This increases the energy level and reduces feed used per pound of meat—fat is rated at 2900 productive energy calories per pound This must be combined with a suitable anti-oxidant to prevent loss of vitamins, particularly vitamin E, when fat is added Improved feed/meat ratios are obtained The question is one of economics The addition of fat will pay only when 1 lb of fat can be purchased for less than the price of 2½ lb of maize or under 3 lb of wheat It is usually included by spraying into the feed as it is being mixed (Assess this cost factor when comparing rations for efficiency of conversions) It is suggested that care be taken with added fat, as although academically desirable for quoting low conversion rates, the flavour—and appeal—of broiler meat is adversely affected with high fat levels A lower conversion rate with more grain—and particularly some maize included—gives a more attractive carcass flavour

2 Vitamin B_{12} (or animal protein factor) added with high level of vegetable protein (unnecessary when meatmeal and milk powder available)

3 For others see ration on p 498 as used 1965 Random Sample Broiler Test

Proprietary mixtures containing desirable added amino acids, vitamins and minerals in correct balance are available

Note The treatment of "broiler" or "griller" mashes with a constant level of a coccidiostat as a safeguard against coccidiosis has given very successful results This should still be coupled with good husbandry practice The use of high levels of antibiotics to control respiratory disease in the growing of grillers has been used Seek veterinary advice

SHOULD THIS RATION BE USED FOR PULLETS?

This will be a natural question The ration set out could be used as all mash for use up to six weeks of age—with minor alterations The antibiotic is deleted, and 15 lb of crushed grain is added to the mixture Greenfeed can be used in place of or in addition to the lucerne meal with a saving on feed, but efficient results are obtained with the lucerne meal From six weeks to eighteen weeks a further 30 lb of crushed wheat would be added

—if on well grassed range increase to 50 lb (For easier reference ... basis rations for 100 lb mixture are given for pullets day old to eight weeks in Chapter 14—see pp 303 and 306)

PELLET FEEDING FOR "GRILLERS" TO TWELVE WEEKS

Some reports listed have indicated a better weight gain (0 1 lb better conversion reported in one trial) where the feed was given in the form of pellets Some efficient growers have reported a combination of pellets and high-energy all-mash ration to aid feed consumption General work appears to indicate that a significant *variation is* not likely as compared *with* a suitable high-energy ration, but pellets could be better than a ration with bran and pollard as a major portion The factor of waste saving may favour pellets under some conditions, and even distribution of ingredients can apply, as listed in Feeding chapter This could mean less feed lost in the litter or on the floor Suitable type feeders with a lip right around and not filled too full go a long way towards preventing this

HIGH ENERGY 16 PER CENT PROTEIN ALL MASH SUITABLE FOR MEAT RAISING 12 TO 24 WEEK STAGE

Allow choice of hard grit or add 1 per cent to the all mash

Ingredients	*By weight*	*By measure*	*Substitutes in part or completely*
Crushed wheat	53 lb	Approx 2½ of 4-gallon bucket	If maize replaces at high level increase manganese sulphate to ¾ oz (20 grammes)
Crushed barley	15 lb	Approx ¾ of 4-gallon bucket	Could be replaced with pollard (if price per lb ⅞ barley)
Crushed oats	10 lb	Approx ⅔ of 4-gallon bucket	Could be replaced with bran (if price per lb ⅔ oats)
Meatmeal (50 cent protein)	14 lb	Approx ½ of 4-gallon bucket	If replaced with 60% protein meatmeal reduce to 12 lb and add 2 lb bone meal *Do not* use 40% protein meatmeal (Adjustments can be made as on p 490 for meatmeal)
Buttermilk or skim milk powder	3 lb	Approx ⅛ of 4-gallon bucket	If replaced by whey powder add 1 lb meatmeal to hold protein level of mash

Ingredients	*By weight*	*By measure*	*Substitutes in part or completely*
Lucerne meal	5 lb	Approx $\frac{1}{3}$ of 4-gallon bucket	Could be left out if good quality greenfeed given at rate of 2 of 4 gallon buckets with each 100 lbs all mash fed
Salt and manganese sulphate	$\frac{1}{4}$ to $\frac{1}{2}$ lb salt and $\frac{3}{8}$ to $\frac{1}{2}$ oz manganese sulphate	1 breakfast cup salt and manganese sulphate	Covers sodium, chlorine and also manganese needs with a crushed grain ration Must be included
Vitamins A and D_3	1 oz of powder, 10,000A, 2000 D_3 level or 2 oz of oil emulsion, 5000A, 1000D_3 per gramme level	Use manufacturer's measure for powder, or $\frac{1}{3}$ breakfast cup oil emulsion	Sufficient to cover all needs for A and D_3 whether intensively housed or on range (Also B_2 can be added refer No 4 p 493)

COMMENTS

1 The above ration is adequate for the needs of intensively housed growing stock to give good growth with meat birds (Also suitable for rearing pullets intensively from 6-18 weeks of age—is similar to ration p 306)

2 When used for outside rearing the quality of the birds could be improved by feeding some of the mash with skim milk.

3 Alternatively, high energy breeder all mash (p 319) could be used

FEEDING COCKERELS FROM DAY-OLD TO TWENTY-FOUR WEEKS

The feed ration on pp 490-2 can be regarded as efficient on available basic feedstuffs to the twelve-week stage and can be fed to grillers being raised on range, in batteries or intensively on deep litter. A variation is necessary after this stage (it will be noted that 25 per cent grain is introduced from the eight- to twelve-week stage with the ration described) The protein level can be reduced to about 16 per cent protein as the rapid growth period has passed, and this will save on feed costs It is inevitable that the feed/meat ratio will fall after the twelve-week stage The table and graph given later show the approximate trend of weight levels for feed and meat. The ration is cheaper for this stage (see costs on p 500) Protein is reduced and antibiotic eliminated The follow-on ration on pp. 495-6 is suited to twelve to twenty-four-week old birds. It can be used for batteries also after twelve weeks old up to fourteen or sixteen weeks See also comments pp 492-4 on use of substitutes and supplements

Note. For a very simple feeding basis of reasonable efficiency see Appendix 1 for concentrate basis approach.

TABLE 22

REQUIREMENTS FOR EFFICIENT GROWTH WITH COCKERELS OR GRILLERS

The average weights suggested are a guide for various ages and the quantities of feed needed per pound of meat, and as a total quantity

These weights are possible in Australia with good crossbred cockerels intensively reared,* given good conditions and fed a high energy ration plus antibiotics (These weights are exceeded by some top line operators, and with good meat strains they *will be exceeded*—particularly for 6- to 10 week stage—with mixed sexes as average for both pullets and cockerels)

Age	*Average weight per bird (in lb)†*	*Average total feed used (progressive total in lb)*	*Average feed used for each lb live weight of bird (in lb)*	*Feed used for each lb of gain*
2 weeks	0 18	0 27	1 5	1 5
4 weeks	0 6	1 2	2 0	2 2
6 weeks	1 1	2 7	2 45	2 5
8 weeks	1 7	4 75	2 8	3 4
10 weeks	2 4	7 4	3 08	3 8
12 weeks	3 1	10 2	3 29	4 0
14 weeks	3 8	13 6	3 58	4 85
16 weeks	4 4	17 5	4 0	6 5
18 weeks	4 85	20 7	4 27	7 1
20 weeks	5 3	24 3	4 6	8 0
22 weeks	5 8	28 5	4 91	8 4
24 weeks	6 3	33 0	5 23	9 0
26 weeks	6 8	38 0	5 6	10 0

COMMENTS ON WEIGHTS FOR VARIOUS AGES IN RELATION TO FEED CONSUMED

1 Weight of feed used as above can be reduced by very efficient management, high grade stock and so on, but it will serve as a basis for reasonable efficiency in the feed/meat conversion rate The weights are based on the results of some official tests in Australia, coupled with results obtained by a number of efficient private operators As a ready reckoner ' Grillers should double weight 4 to 6 weeks and double again 6 to 10 weeks "

2 Range rearing will show a saving of feed, which can be a big factor where cheap range conditions are available V H Brann and F H Hart in "Table Poultry", New South Wales Department of Agriculture publication (1952) reported trials from Hawkesbury College These showed savings on range for feed used, compared with battery reared stock, of 13 per cent to 12 weeks, 15 per cent to 16 weeks—and 20 per cent to 24-week stage, as average basis

3 A high-energy ration experiment conducted in 1954 at Seven Hills Experiment Station, New South Wales, with White Leghorn cockerels

* Refer to comments for feed saved with range rearing

† These weights should be reached approximately two weeks earlier with early-hatched cockerels and meat strain chickens (for example July) and possibly some days later if rearing during the hot months

gave efficient results under intensive conditions. The cockerels weighed 1.66 lb. at 8 weeks with 2.8 lb. feed used to 1 lb. meat,* and 2.65 lb. at 12 weeks with 3.6 lb. feed used to 1 lb. meat. This was compared with a normal ration. Growth at 12 weeks showed a saving of 2.4 lb. of feed used per bird, or a reduction of approximately 20 per cent in feed used. This gave a lower total cost of feed. (An experiment at Seven Hills in 1959 with a high-energy fat-supplemented feed gave a much improved conversion of feed to meat equal to overseas results, but the ration was not economic.)

4. High Energy Special Broiler Ration as fed to birds in Sixth Random Sample Broiler Test 1965, Hawkesbury Agricultural College.

(The cost of the ration per lb. was approximately 4.7c. and gave 2·5 conversion meat strain chickens.)

Ingredients	*Weeks 0-6*	*Weeks 6-9*
	lb.	*lb*
Wheatmeal	43½	47½
Sorghum	10	15
Oats	5	5
Meatmeal (50% protein)	10	10
Soya bean meal	10	4
Peanut meal	6	5
Liver meal	2	2
Blood meal	2	2
Stabilized Tallow	5	5
Vitamin Concentrate†	1	1
Christmas Phosphate	½	½
	100	100

The ration was formulated by M. W. McDonald formerly Poultry Research Station, Seven Hills.

†Vitamin Concentrate
Made up of
Vitamin A—9.6 million units per ton
Vitamin D_3—2,000,000 units per ton.
Vitamin E acetate—1 gram per ton (as 25 per cent stabilized concentrate)
Riboflavin—2.5 grams per ton.
Calcium pantothenate—2 grams per ton.
Pyridoxine H Cl—2 grams per ton.
Menadione $NaHSO_3$—1 gram per ton.
Manganese Sulphate—200 grams per ton
Zinc Oxide—20 grams per ton.
Santoquin—0.125 lb. per ton.
D L. Methionine—1 lb. per ton.
Procaine Penicillin—6 grams per ton.
3 Nitro phenylarsonic acid—25 grams per ton.
Wheatmeal to 20 lb. as "filler".

Cockerels weighed 3.63 lb. and pullets 2.87 lb. on this ration at 9 weeks with 8 lb. feed used as average for meat strains.

5. Some private operators using crossbreds have obtained better growth rates than those shown in the table with 3 lb. at 9 to 10 weeks and well over 4 lb. before 15-week stage.

For comparison, to illustrate the improvement in the genetic background to the meat-bird strains, and some effect from ration variation, the 1962 Test Average was 3·41 lb. at 11 weeks of age, with 2·7 conversion (crossbred cockerels 3·18 with 2·8 conversion—but costing much less at day-old) compared with 1965 test average of 3·2516 at 9 weeks of age with 2·5 conversion.

6. As a general basis 3 lb. live weight appears the most profitable weight compared with feed used, and the best time to make sales.

7. Cockerels reared for the full period to 6-month stage can be regarded as efficiently reared with a basis of 1 lb. of meat per month of age. The feed

* This result compared with overseas work, as one trial listed 1.7 lb. weight at 10 weeks for 2.64 lb. feed per 1 lb. meat.

used for each 1 lb. of gain on birds should be carefully considered The table shows that 4 lb. of feed adds 1 lb. weight at 10 to 12 weeks, whereas 9 lb. of feed is necessary to add 1 lb. weight at 22 to 24 weeks

8. Pullets being reared (ordinary crossbreds) can be expected to show a reasonably good conversion efficiency, but owing to the smaller weights (approximately two-thirds that of the cockerels) obtained they are not as profitable as cockerels for the 12-week market. However, this has been improved with special meat lines. Weights of feed and growth for pullets would, under good feeding and management conditions, be approximately three-quarters of those shown for the cockerels This has been indicated in the 1962 Hawkesbury College Second Random Sample test for "broilers". The pullets for the meat strains averaged 2 96 lb and the cockerels 3·85 lb. at 11 weeks of age (See p 498, No 4)

Comment Figures listed show that for a given amount of feed, high efficiency can be obtained at 9 to 12 weeks, which is the basis quoted for table-poultry production in other countries The rates of growth taper off after this stage, hence in any discussion on feed/meat ratio, it must be made clear as to the age of marketing to enable a true economic picture to be presented. The rates paid per pound at 3-month stage would show a greater margin of profit, but if price per pound was higher for older birds, the fully grown bird could pay well (with low mortality) in relation to feed used and labour.

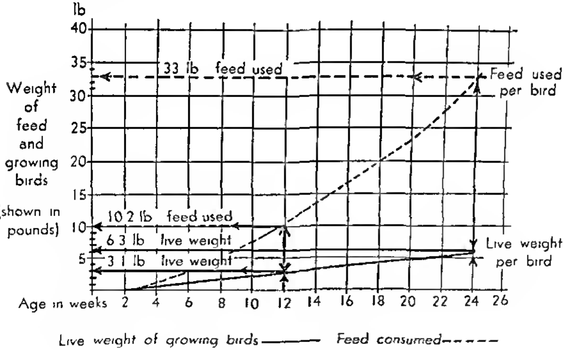


Fig. 170 Graph showing average feed/weight ratios when rearing under intensive conditions with cockerels and meat-strain stock

Read by moving up from bottom line then across

ECONOMICS OF TABLE-POULTRY PRODUCTION

The various factors involved with table-poultry production costs are as follows (Current expenses listed—capital cost discussed earlier, allowance

made for interest and depreciation on this is approx 1c per lb with floor raising and 50 per cent more on wire)

SUGGESTED BASIS FOR COSTS

Day-old Cockerels

The question of these costs was discussed earlier in this chapter under Combination of Breeds A suggested example of 8c ($7 50 per 100 day-old crossbred cockerels) can be taken For meat line mixed sex chickens the cost may be approximately 15c to 18c—hence the need for heavier weights with these for economic parity with crossbred cockerels when available

Mortality Costs

This is a big factor in the cost basis with table poultry (In the United States, where the margin over costs is very small, a rise in mortality above normal may be sufficient to wipe out the profit on large batches of broilers) The allowance that has to be made is on the basis of day old cost, plus whatever feed is consumed If an example of feed at 3c per lb is taken and the day old cost listed above, then a 10 per cent loss could mean (per 100 cockerels) 10 at day-old cost of 8c, plus 2 lb of feed consumed (presuming that losses are mainly in the first six weeks) per cockerel lost, would mean 75c day-old costs for 10, plus 20 lb of feed at 3c per lb, costing 67c This gives a total of approximately $1 40 to be carried by the remaining 90 or nearly 2c per cockerel raised If 15 per cent loss occurred, then on same basis the remaining 85 cockerels would have to carry a debit of 3c each (In the case of meat line mixed sex chickens respective debits would be 2c and 3c) Losses should be kept under 15 per cent or the returns will be poor, because in addition to this early debit there would be only 850 from 1000 at day old stage to sell at 12 or 24 weeks—but the overhead expenses would not be reduced to any marked degree Mortality level will be largely determined by good husbandry—careful attention, lack of overcrowding, and the right diet and conditions for each stage

Feed Costs

This is the major item of costs The control of this item is brought about by reasons as listed above for keeping mortality down, namely good management and conditions Feed costs vary greatly from one grower to another with the same source of stock and the same ration fed—there is no substitute for the management factor As a general basis the feed consumption listed in the table and the graph can be taken as the quantity of feed (approximately 10½ lb for 12 weeks, 18 lb for 16 weeks, and 33 lb for 24 weeks, feed consumed per cockerel raised)

Note Allow for an increase in the feed used for a given weight of meat during hot-weather rearing periods

A basis of costs for the feed will be given and adjustment can easily be made for higher or lower costs in the area in which the plant is operated The high-energy ration for the first twelve weeks would be high in cost on

per pound basis, as discussed previously With crushed grains approximately 2c per lb (\$54 per ton), meatmeal approximately 4c per lb (\$84 per ton), milk powder approximately 7c per lb (\$140 per ton) plus lucerne meal 2c per lb (\$40 per ton) and A and D_3 emulsion (\$6 per gallon or powder equivalent), plus antibiotics, the cost would be approximately 3c per lb (approximately \$66 per ton) without labour for mixing Adjustment can easily be made for local costs (If a prepared mash was purchased based on this formula, then approximately 3c per lb (\$72 per ton) could be allowed—if the prices of these examples ruled for the ingredients, although this may be reduced if buying cheaply in big lots) The second ration has the expensive ingredients reduced in quantity, also antibiotics are not included, hence the cost is reduced to approximately 2c per lb (Use of special rations costing more would be based on their comparative conversion efficiency)

Allowance for Brooding, Working Expenses, and Overhead Costs

The general working expenses associated with any business must be allowed for Brooding costs suggested as a general basis earlier in the book were allowed as 5c per chicken, but by handling bigger numbers, as is the practice with many table-poultry raisers, this could possibly be reduced to 2c General repairs, transport costs, water charges, maintenance of plant, veterinary expenses for vaccinations, interest and depreciation have to be allowed for This varies widely from one area to another—a general basis that can be used is 10 per cent of costs in addition to the brooding charge These are the principal items involved with costs indicated here

BASIS OF RETURNS WITH MARKETING OF TABLE POULTRY

The returns that will be obtained for the various ages of birds cannot be stated as any set figure The initiative of the operator in seeking markets on a regular contract basis can play a big part Also, be careful to locate the plant near a good market if possible With full grown birds the time of the year is a big factor—the Christmas market being the highest Cold storage facilities have extended this period beyond what it was formerly Business acumen and supply and demand will play a big part The general basis of returns is tied up with the quality of the table poultry meat offered to the market Returns are available shortly after entering the business with grillers, but check markets first The only suggestion which can be made is to prices available from either

(*a*) The auction market, and check normal handling charges

(*b*) Direct sales on a contract price to retailers or private consumer connections—live or dressed poultry basis

(*c*) Sales direct to abattoirs, or buyers who collect on the farm

(*d*) *Contract operation* Large scale processors arrange contracts They usually supply the chickens, feed and services, and the grower the sheds, equipment and labour Payment is on live weight per lb basis, *or* a set amount per bird, plus incentive for quality and weights,

This operation guarantees the market—at the price offered The grower can assess regular return against possible higher return with private operation, but possibility of less regular markets This is a matter for personal decision A market "tie up" of some type must be made before any large scale operation

LIVE AND DRESSED WEIGHT

When enquiring concerning prices make sure to allow for the margins involved with live weight and dressed weight An allowance should be made approximately on the following basis

Birds bled and stripped of feathers, but not drawn, lose about 10 per cent of the live weight—for example a $2\frac{1}{2}$-lb bird would lose $\frac{1}{4}$ lb, reducing to $2\frac{1}{4}$ lb, and a 5-lb bird would lose $\frac{1}{2}$ lb, reducing to $4\frac{1}{2}$ lb

Birds dressed ready for cooking vary greatly according to whether the birds are well fattened or not As a general basis the approximate dressed weight is from 66 to 70 per cent of the live weight, that is a loss of approximately one third of the bird A bird weighing 6 lb live weight would be approximately 4 lb dressed weight (As an item of interest the most edible portions of poultry—breast, wings, and legs—comprise nearly 50 per cent, but in well fattened intensively reared young birds may reach nearly 70 per cent of the dressed weight)

The loss in well grown young grillers or small roasters ("broiler" stage) will not be more and may be less than the percentage figure above (in 1958 S A trial well grown cockerel grillers on ration shown pp 490-2 dressed nearly 74 per cent of live weight) Poorly grown young birds may lose a proportion of up to 40 per cent or nearly 50 per cent

Loss of 33 per cent would mean that 3 lb birds live weight should dress 2 lb ready for cooking, and 6 lb birds should dress 4 lb Hence, as an example, if 25c per lb was the price for live weight basis, this would mean 28c needed for stripped and bled and 38c per lb needed dressed ready for cooking for same return (without allowance for labour of dressing) Dressing cost assessed at 20c per bird would mean 48c per lb total cost on the 2 lb bird, and about 43c per lb on the 4 lb bird (For 20c per lb live weight basis respective figures would be 22c bled, 30c. dressed, 40c on 2 lb, and 35c on 4 lb birds)

COSTS AND RETURNS FOR VARYING AGES

Costs are based on the examples quoted under Suggested Basis for Costs and returns are given for prices ranging from 20c to 35c per lb live weight Adjustment can easily be made for variations ruling for feed or meat prices The examples are given as a basis upon which to work in a decision as to returns likely and also number of birds to be raised to show a reasonable living The costs are given for intensive rearing—range rearing can reduce the feed item by 10 to 15 per cent (See pp 500-1 for details of basic costs)

The example opposite shows possible returns with low mortality and efficient management The number of cockerels or mixed sexes that would have to be raised can be arrived at by the idea as to what is considered by the operator as necessary to constitute a good living A fall in price would

EXAMPLE I

RAISING COCKERELS TO 12 WEEKS (GRILLER, OR SMALL ROASTER STAGE)

EXPENSES

Item	*Cost*	*Percentage of total cost*
Day old crossbred cockerel*	8c	14%
Mortality allowance on 15% early loss basis	2c	5%
†Feed cost when using 10½ lb @ 3c per lb	35c	66%
Brooding cost	2c	5%
Allowance for working expenses and overhead costs (includes interest and depreciation)	5c	10%
(Cost per lb live weight without labour = 18c)	52c	100%

RETURNS

(with feed/meat ratio 3 5 lb feed to 1 lb meat and total costs shown as 52c per 3 lb bird average)

Price per lb live weight	*Gross returns per 3 lb bird*	*Margin for Labour over costs*	*Percentage margin on costs*
20c	60c	8c	14%
25c	75c	22c	42%
30c	90c	38c	70%
35c	$1 05	52c	100%

Returns with mixed sexes to 11 weeks of age

The 1958 South Australian Department of Agriculture trial with crossbred pullets and cockerels gave the following results with feed based on the high energy all mash ration listed in this chapter pp 490 92

9 weeks age weight, 1 lb 14½ oz for 6 lb 14 oz feed (3 6 to 1) and 11 weeks 2½ lb for 9 lb 12 oz feed (3 9 to 1) for pullets

At the same time cockerels were raised to 3 lb 2 oz for 11 lb 1 oz feed in 11 weeks (3 54 to 1)

With feed at 3c per lb, purchase cost as mixed chickens (15c each) mortality and brooding costs and allowance for depreciation and interest—this gave a total cost of 23c per lb for pullets exclusive of labour (The profit margin at 25c per lb was 3c per pullet raised)

The cockerels at 7c each, day old, cost 18c per lb to produce exclusive of labour, giving 24c profit margin, but if charged at 15c for mixed sexes then 16c margin at 25c, per lb

This gives a basis when ordinary crossbred mixed sexes must be purchased The average return for the cockerels and the pullets is the net return for mixed sexes In this case cockerels at 25c per lb, 16c margin and pullets 4c margin would give average of 10c per griller exclusive of labour, and with 20c per lb cockerels only show a profit—2c per lb (Meat line mixed sex chickens would be expected to give returns comparable with those for the cockerels)

* If meat line mixed sex chickens are purchased then this cost may be increased 8c This could increase cost to 20c per lb but better feed conversion and growth should compensate for higher purchase cost, and maintain the figure of 18c

† With a more efficient feed of higher energy 8 lb only may be used but cost may be the same at higher price per lb

mean a marked increase in output to maintain sufficient return The availability of supply for cockerels or meat line chickens over the year will also be an influencing factor The question of private or contract operation has been discussed previously Three lots (and up to four) could be put through in a year—allowing for cleaning up in between and for delay in maturity—for example those reared in the summer period—or the continuous operation system be used 20,000 to 30,000 can be raised in a year with a well laid out plant and with well planned schedule and market connection up to 50 000 is possible Details have been given on this question earlier in the chapter (See pp 479 81)

A comparison can easily be made with the returns for the 16-week stage The increase in costs per pound is not very high, but an increase in price per pound would be necessary to show a return for the longer period of handling young stock It would be difficult to put through three lots in a year with this rearing time (unless overlapping early brooding stage could be arranged)

EXAMPLE II

RAISING COCKERELS TO APPROXIMATELY 16 WEEKS (SMALL ROASTER OR PRIME ROASTER STAGE)

EXPENSES

Item	*Cost*	*Percentage of total cost*
Day-old cockerel	8c	10%
Mortality allowance on 15% early loss basis plus 2½% at later stage	3c	4%
*Feed cost when using 18 lb, @ approx 3c, per lb	57c	73%
Brooding cost	2c	3%
Allowance for working expenses and overhead costs (includes interest and depreciation)	8c	10%
(Cost per lb, live weight=approx, 20c, without labour)	78c	100%

* The feed cost per lb is less after 12 weeks, owing to cheaper ration used, hence saves ½c per lb overall (Comment for meat line as for Example I)

RETURNS

(with feed/meat ratio 4 5 lb feed to 1 lb meat and total costs shown as 78c per 4 lb bird average)

Price per lb live weight	*Gross returns per 4 lb bird*	*Margin for labour over costs*	*Percentage margin on costs*
20c	80c	2c	3%
25c	$1 00	22c	29%
30c	$1 20	48c	61%
35c	$1 43	62c	80%

Range rearing could reduce feed item by up to 10% or 2 lb of feed=6c

This further comparison gives additional data on the various stages of rearing and likely returns The varying items as a percentage of cost for the 12- and 24-week stages are interesting The labour item is the big factor, as the return per pound on range is nearly as good at 24 weeks as 16 weeks, but the cockerels have to be carried for 50 per cent longer time and outside range practice calls for more labour needed Also increased housing accommodation is required

EXAMPLE III

RAISING COCKERELS TO 24 WEEKS (PRIME ROASTER STAGE)

EXPENSES

Item	*Cost*	*Percentage of total cost*
Day-old cockerel	8c	6%
Mortality allowance on 15% early basis plus 5% at later stage	5c	4%
*Feed cost when using 32 lb @ 3c per lb	96c	78%
Brooding cost	2c	2%
Allowance for working expenses and overhead costs	12c	10%
	$1 23	100%
(Cost per lb live weight = 21c without labour)		

* Feed consumption for intensive rearing—good range-rearing conditions could reduce 20% equals 6 lb, feed approximately 20c, reduction in costs to $1,05, This reduces cost per pound live weight without labour to 18c,

RETURNS

(with feed/meat ratio 5 3 lb feed to 1 lb meat intensively and 4 1 lb to 1 lb on free range Total costs shown as $1 25 for 6 lb bird average for intensive rearing, and $1 05 for range rearing)

Price per lb live weight	*Gross returns per 6 lb bird*	*Intensive*		*Free range*	
		Margin for labour over costs	*Percentage margin over costs*	*Margin for labour over costs*	*Percentage margin over costs*
20c	$1 20	5c loss	4% loss	15c	14%
25c	$1 50	25c	20%	45c	43%
30c	$1 80	55c	44%	75c	71%
35c	$2 10	85c	68%	$1 05	100%

RANGE REARING

The cost of feed can be reduced by nearly 20 per cent with cockerels reared to this stage under good free-range conditions, as shown in the table of returns This means approximately 6 lb of feed worth nearly 20c, which would reduce the costs to $1 05 for a 6 lb bird, which is 18c per lb —equal to the intensively reared broiler stage cost per pound, but without labour in both cases The period of handling is twice that of the "broiler" stage This free-range return shows that a sideline unit on a farm could be a profitable undertaking with reasonable prices for meat

GENERAL DISCUSSION ON ECONOMICS OF EXAMPLES LISTED

1 Management is the greatest single factor in results—if the mortality rose above the figures given (15 to 20 per cent) owing to neglect in husbandry, for example, coccidiosis outbreaks, fowl-pox, overcrowding, poor feeding, the returns would be drastically cut—20% additional loss at 8 to 10 weeks due to coccidiosis or worm infestation, would cut the returns per head of those surviving by over 10c It would also reduce the number marketed for 100 started to only just over 60, which would mean the profit lost on all those which died (25 over normal) and as other costs would still be the same, gross returns could be cut by nearly one third Hence it is vital that mortality be kept down to 10 to 15 per cent for the early stages to ensure efficient returns Improvements in efficiency by allowing ample space and giving that careful personal attention for which there is no substitute with stock will enable higher weights with less feed than the examples given

2 The intensive floor system gives the best results in relation to labour usage for 12-week and 16-week stages, and the battery-rearing system can be used successfully Cockerels raised beyond this stage would appear most economical if raised on range, but can be reared intensively given sufficient room

3 The marked influence of costs of day-old cockerels and brooding charges—approximately 20 per cent of the production cost for 12-week stage—tends to disappear at the 24-week stage, being only approximately 10 per cent of the production cost (respectively 30 per cent and 15 per cent in case of meat line chickens) This compensates to some extent for the increased feed/meat ratio The cost per pound of meat at 12 weeks for these costs is 3c, while they have fallen to 2c per lb of meat at 24 weeks, which is equivalent to 0 5 lb of feed on the feed/meat ratio

4 The labour margin will be the main deciding factor, the quicker turnover in the early stages means the possibility of handling four lots (or even five if brooding is overlapped) in a year instead of only two with five- to six month birds, and in the same space taken for the two lots of fully grown birds For a commercial project 3 lb birds can be expected to give the greatest return with prices of 25c to 30c per pound live weight ruling for all ages, as the actual percentage margin over costs would be approximately the same as for the other stages, plus the advantage of

half the period of handling This would make possible four or five lots per year instead of only two, thus increasing the returns on an intensive unit with the same space used by 50 per cent and up to 100 per cent

5 A sideline unit on a general farm could be very efficiently handled on the 24-week basis where it may be desired to raise only one run of stock —possibly for the Christmas market (And if skim milk available—can reduce costs to marked degree See also pp 283 and 343)

6 The possibilities of running one or two lots of 10 to 12 week birds may interest some as a sideline on a commercial egg farm when the intensive rearing quarters are unoccupied, *but in general specialization* pays

ECONOMICS OF RAISING WHITE LEGHORN COCKERELS

Some operators, both here and overseas, have raised White Leghorn cockerels to the early growth stage with success The quick growth factor of the White Leghorn (utilized in the crosses discussed earlier) makes this possible

The feeding required would be the high energy ration listed in this chapter Intensive rearing would be the normal practice The weights for 8 and 12 weeks were listed earlier An example for possible costs and returns is given (feed costs and prices as for the previous examples given)

EXAMPLE IV

WHITE LEGHORN COCKEREL RAISING TO TWELVE WEEKS*

EXPENSES

Item	*Cost*	*Percentage of total cost*
Day old cockerels (average price)	3c	7%
Mortality allowance on 15% early loss basis	2c	5%
Feed cost when using 10 lb feed at 12 weeks @ approx, 3c, per lb,	33c	73%
Brooding cost	2c	5%
Allowance for working expenses and overhead costs (includes interest and depreciation)	4c	ap 10%
	46c	100%
(Cost per lb, live weight without labour 18c)		

* *Sale of White Leghorn cockerels as Poussins 7-8 weeks stage—*

(a) Costs as for 12 week stage, less 4 lb feed reduces total costs to 32c (Feed/meat ratio 3 4 to 1)

(b) The weight would not exceed 2 lb and could be expected to average about 1¾ lb

(c) Returns for labour over costs with 1¾ lb baby broilers or poussins would be , 20c, 25c and 30c per lb live weight 2c 11c and 20c respectively per bird

RETURNS

(with feed/meat ratio 3 6 lb feed to 1 lb meat) and total costs shown as 46c for birds weighing 2 65 lb

Price per lb live weight	*Gross return per 2 65 lb bird*	*Margin for labour over costs*	*Percentage margin on costs*
20c	54c	8c	16%
25c	67c	21c	45%
30c	79c	33c	73%

The comparison with the previous examples show that quickly grown White Leghorn cockerels compare for margin over cost basis The flesh is choice white flesh, but the price received may not be quite as high as for crossbreds, hence rates have been quoted up to 30c only Efficient handling can give these results, which show that White Leghorn cockerels should not be despised, as given a reasonable price level they can be profitable

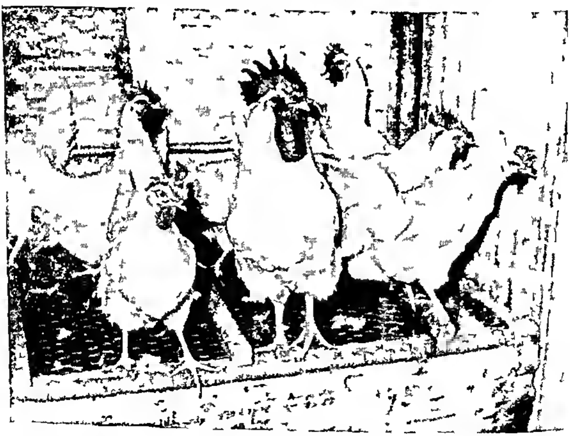


Fig 171 A view of meat strain breeding stock Meat lines have been evolved in Australia by crossing various breeds Some lines (as shown) produce male birds to mate with breeds such as Australorps to produce meat chickens Other strains are produced as a separate breed

SIZE OF A TABLE-PRODUCTION UNIT

This has been covered for each type of unit—free range, battery rearing, or intensive—under separate headings earlier in the chapter, together with

possible cost basis for units from 5000 to 40,000 or more birds yearly per operator.

The general assumption, from an economic angle, based on Examples I, II, and III given for costs and returns, could be as follows

With feed prices at suggested figures of 3c. per lb for initial stages to 12 weeks, and 3c. from 12 to 24 weeks, the costs shown, with the ration listed, would allow approximately 22c. per bird raised to 12 or 16 weeks for labour margin at an average of 25c. per lb. live weight, with reasonable mortality and well-grown birds.

On this basis of 25c. per lb. live weight it would be necessary to market somewhere in the vicinity of 10,000 birds (11,000 to 11,500 started) to give a return of just over $2200 for the hours of labour involved (routine attention required over seven days per week and evening checks) * With these costs, and an average price of 30c. per lb. live weight, giving an average margin of 42c. for 12- to 16-week birds (38c. at 12 weeks and 48c. at 16 weeks) somewhere in the vicinity of 5000 birds would have to be marketed (approximately 6000 started) to give a comparable return. (Adjustment can be made for lower feed costs or higher or lower meat prices by reference to Examples I, II and III, pp. 503-5.) Calculation can easily be made for increased returns for a larger-sized meat-raising unit.

The first case of 25c. per lb., for 10 to 12 weeks stage, would involve somewhere about 2500 to 3000 on hand at one time, and up to 6000 (with brooding overlap. See p. 481). For 24 week stage, if free-range conditions were available, and saving of feed valued at 20c. per bird for 24 weeks was made, then on a 30c. per lb. basis (with 24-week-old stock showing a margin of 75c. over costs) 3000 marketed (approximately 3500 to 3750 started) would give an equivalent return in 7 to 8 months. If 25c. per lb. received, then 5000 would have to be marketed for this return. These figures are examples only and are based on good husbandry. Increasing or maintaining the return by handling more birds depends on the initiative, also operational and plant efficiency of the person concerned. The whole question is based on the price for feed and meat An assessment can be made by altering the figures in the examples for local costs and returns, and read in conjunction with the capital cost items given earlier for plant. It must be realized that a few pence per pound can make all the difference—5c. per pound decline can treble the number of birds needed to be raised for a given return.

COMPARISON OF TABLE-PRODUCTION AND EGG-PRODUCTION RETURNS

The reasons behind the alternatives of eggs or meat can be a big factor in comparing the two branches of poultry production as a livelihood. Skill in rearing is necessary with both and more so with cockerels or grillers because one has to "keep it up all the time". The saving of labour

* With a price of 20c. per lb. giving 8c. per bird profit it would be necessary to raise 30,000 or more to give the same return—a few cents per lb. has a big influence.

with collecting, cleaning, and packing of eggs (approximately 50 per cent of time on the egg production farm) will be a factor with some The desire for breaks between batches of grillers to give leave periods is another factor, and so on The close proximity to suitable table markets with ample transport could be another factor The financial comparisons are difficult to make This discussion follows on the basis that has just been given for the size of the table poultry unit for possible returns of $2200 with table poultry Reference to Chapter 7 will show that a comparable return has been listed, for a suggested example of egg prices and feed costs, per 1000 layers with 75 per cent pullet percentage If these costs and returns figures applied it could mean handling 10,000 "griller" stage cockerels or 5000 prime roaster cockerels as compared with each 1000 layers with 75 per cent pullet level over a year This comparison is entirely dependent upon movements in the price of feed and eggs or table meat A comparison, which can be adjusted for local returns, could be if contract rates on live weight prices made possible a net return of 12c per griller, giving $3750 on 30,000 marketed, would be matched in return by 2500 layers, if giving a net return of $1 50 margin per bird

MANURE SIDELINE WITH TABLE PRODUCTION

The manure available per 1000 young grillers reared to 12 weeks has been given as approximately 3 tons of good dry litter The dry manure available from 1000 cockerels reared to 24 weeks would be approximately 6 to 7 tons The value of this excellent fertilizer has been covered in detail in Chapter 13, on Deep Litter, and reference can be made to it for suggested returns This will form an additional item that can be regarded as free of production cost other than labour involved in handling the disposal of the manure (It *could* mean, at $12 per ton, an extra 3c per broiler)

SALE OF FEATHERS AS A POSSIBLE SIDELINE

If dressing of the birds is carried out on the unit for a special trade (on contract basis) an additional source of revenue can be exploited Poultry feathers have a saleable value for pillows and mattresses This type of contract depends on the initiative of the operator Feathers from dry plucked birds are most desirable, otherwise special driers are usually needed where the birds are wet plucked

A REMINDER—HANDLE BROILER-STAGE COCKERELS CAREFULLY

Young cockerels are very tender at this stage They bruise very easily when being handled, and this shows up on the carcass Careful catching by the leg is usually the best way Avoiding disturbances in the pen will also help, as these young birds may bruise if they take fright

GRADING OF MEAT BIRDS FOR MARKET

Some confusion may exist on this point, and the following is given The four grades of poultry (as listed in "Broiler Growing", New South Wales Department of Agriculture publication, 1960) are

Poussins—chickens 7 to 8 weeks old weighing up to 1 to 1¼ lb each

Grillers—9 to 11 weeks old usually weighing 1½ lb and up to 2¾ lb (Increased growth rates now obtained make weights of 3 lb. or over possible by 11 weeks The American classification for young chickens about 10 to 12 weeks old and weighing up to 3 lb or more is "broilers or fryers" and in the United Kingdom it is "chicken" The term "broilers" is popular in Australia for this age bird)

Small roasters—12 to 15 weeks weighing 3 lb up to 4 lb

Prime roasters and Capons—over 4 months and up to about 7 months weighing over 4 lb (Examples of weights have been given with chart of up to approximately 6½ lb)

RAISING OF CAPONS

The raising of capons is the production of one of the finest grades of large poultry, but it has not received a great deal of attention in Australia The reasons which can be regarded as mainly responsible for this are

1 Labour requirement—as it is necessary to hold capons until eight months of age, and up to ten months to gain benefit from the operation

2 Lack of a suitable market prepared to pay a premium rate for this type of poultry meat (Some operators have established a limited private market that will pay this premium but no large scale marketing has operated)

3 Knowledge of the technique required for operating on the birds, the setback that occurs, and the heavy feed consumption in the latter stages

The above reasons give some idea of why there is not a specialization in the raising of capons, also the tender quick-grown flesh of young grillers or small roasters is a counter-attraction, and more easily obtained However, if a large bird of 6 to 7 lb dressed weight is wanted with flesh equalling that of a young cockerel, the capon is one way to get it The feed/meat ratio will be higher with the capons It makes possible the marketing of quality meat for a special private market over a full year, when raising for a limited period only, by selling the first portion as young birds and the latter portion caponized Can be raised under intensive conditions or on range Capons do not fight and have even been used as foster mothers for chickens Their appearance differs from cockerels, as they have very little comb or wattle development, making the head appear small The hackle, tail, and saddle feathers grow long, making the bird appear heavily feathered They usually grow more slowly than cockerels up to six months, but make more growth than cockerels after then An example of suggested costs is given

cost of surgical operation For costs and returns at 6 month stage use the calculations given for cockerels in Example III to 24 weeks of age The same basis will apply and the cost of one pellet only may be necessary at 14 weeks or a maximum of two, one at 8 weeks and one at 14 to 15 weeks This would be the only extra rearing costs Further details re caponettes follow later in the chapter *Note* Reference made earlier (p 486) for need to check State Departments of Agriculture for rulings on use of this practice.

SURGICAL CAPONIZING OPERATION

Age and type of birds suitable The birds suitable for caponizing should be heavy breeds or crossbreds for best results in growth, but White Leghorns have been successfully reared as capons with moderate returns The normal stage for caponizing is about 2 to 2½ months—before that it is very difficult and after 3 months too many "misses or slips" are likely to occur The birds should be quite healthy—caponizing will not make a good capon out of a backward bird A set of caponizing instruments (approximately $7 to $12) should be obtained The instruments needed

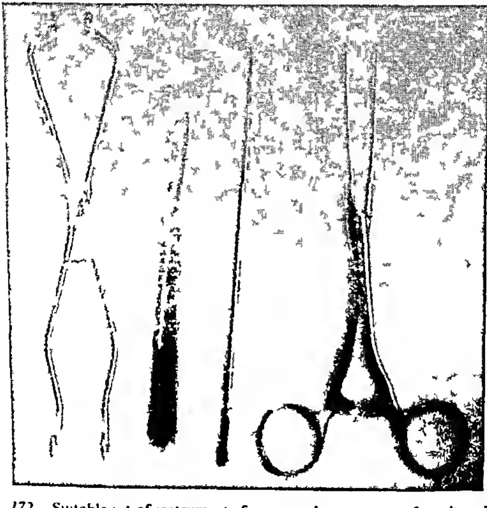


Fig 172 Suitable set of instruments for surgical caponizing of poultry From left the instruments are spreader, scalpel, sharp pointed probe and extractor A pair of tweezers is an additional item which is very handy

—(*From* Capons and Caponizing *by the late* M H Abel)

skin at this point, with the left hand, pulling it to the left *away* from its normal position (the reason is that when the operation is complete the cut in the skin will not be over the point where the incision between the ribs is showing) Now, while holding the skin tight feel with the nail of the forefinger of the right hand for the two last ribs, and with the place located make the incision (with the scalpel in the right hand) about one inch long *between* the last two ribs well up towards the backbone

This is the important part—a cut in the wrong place can make it very difficult to carry out the operation, and if too far forward, the cut will be made into the air sac or the lungs (refer to the illustration as a guide) Then place the spreader between the two ribs and lock it to hold the opening about half an inch wide The thin membrane inside is then perforated with the sharp end of the probe The testicle should then be observed on the right-hand side up against the backbone—the size is about that of a bean Some search may be necessary if the intestines are not flat (because of insufficient fasting period) or if the light is poor, by pushing the intestines aside with the blunt end of the probe With the testicle in view, insert the extractor carefully and with the jaws slightly open just enclose the organ and then close the extractor Then carefully twist the extractor around, pulling upwards slightly until the organ is severed without any remaining—or the bird will be a slip Great care must be taken to avoid the main artery, which can be seen between the two testicles—if this is pinched or punctured by the extractor the bird will rapidly bleed to death Then turn the bird over and repeat the operation from the other side It is possible but risky unless one is very skilled (and even skilled operators have some casualties) to take both testicles from one side The difficulty is avoiding the artery between If this is done, take the lower testicle first, using great care, then if any slight bleeding occurred the upper testicle could still be seen Keep all instruments in sanitary condition by washing frequently in the antiseptic, and swabbing the point of incision before and after is suggested

The operation does not cause any apparent discomfort to the bird when properly carried out and birds have been observed snapping at flies while the operation is being done After the operation place the birds in a pen (not over twelve in number) with other capons only (not with cockerels or hens) Do not have any roosts and feed on soft food (mash) only for some days, and water to be available without having to jump up on a rail for it

After a week or so they can be put out on range (or reared intensively) Some wind puffs may develop owing to air escaping from the body cavity before the incision is healed, and being trapped under the skin Puncturing the skin with a scalpel making a small "X" cut is all that is required The appearance of the capon after a fortnight or so gradually develops as described earlier Feeding can be on the rations set out in this chapter, and topping-up for the last three weeks before marketing will improve weight

The capons are very quiet and do not fight, and can be raised with about three square feet per bird intensively They are very choice meat and the economics of this practice have been given earlier.

CHEMICALLY CAPONIZED BIRDS ("CAPONETTES")

Note Check reference given p 486 re use of hormone caponizing practice The use of hormone preparations to bring about a condition akin to that of the capon, has made considerable progress in the industry This practice is carried out with small roasters as well as older birds, and may be done with grillers The effect is very noticeable Within about a fortnight of injection the comb shrinks in size as with a capon and they do not crow They often quickly become docile In some cases cannibalism and pecking may occur, necessitating debeaking and toe-clipping * The effect only lasts for a period about eight to twelve weeks, varying in different cases (and odd "slips" occur) The texture and colour of the flesh is improved, and a slight increase in weight is obtained There is slightly more fat around the abdomen, and better quality breast meat The growth is more even than with untreated birds This is a practice that has a definite place in poultry-meat production and produces a better young table bird than otherwise would be obtained In a number of cases injecting young cockerels that are fighting may prevent further trouble It can be used for intensive or free-range rearing alike $7\frac{1}{2}$ m g pellets are available for caponizing for early stage sales, and they stop crowing and reduce comb growth These or the 15 m g pellets do not show an economic gain with sales at 10 or 12 weeks Young birds marketed at the twelve- to sixteen-week stage can be injected at about eight or ten weeks with one 15 m g pellet If being kept longer another injection is necessary The injection can be left until about twelve to fourteen weeks with birds being marketed at twenty to twenty-four weeks With birds at three or four months one pellet is injected (whether one was given at eight to nine weeks or not) and this will carry the bird to the five- to six month marketing stage If carried beyond this inject two pellets to last until about eight months and then three would be necessary (Approximately one pellet per $2\frac{1}{2}$ to 3 lb live weight has worked well in the field)

METHOD OF INJECTION

The injection is simple and is made by means of a special injector that implants the pellet under the skin of the bird The pellet used fits the injector (use the brand of pellet that suits the injector you have—some are different sizes) and each pellet contains fifteen milligrammes of stilboestrol Paste has also been used for injection, giving the same dosage This is injected just under the skin high up on the neck just behind the skull (or head) Hold the injector in line with the neck (parallel) to avoid the risk of losing the pellet by injecting outside the skin † It is important that the

* This is necessary not only to stop losses following the injection in these cases but to prevent scratched backs and spoiled carcasses Ordinary "snippers" can be used for quick operation

† The young grillers will usually scour after the injection—it increases appetite and they drink more water The control for this is to maintain the same rate of feeding for the grillers as ruled at the time of injection for about a week This may only be possible with a set feeding routine instead of free choice Some large scale operators have found that regular feeding of set quantities can give better weight gains than free choice at all times There is less scouring with high energy, than with low energy feeds and increased feed intake

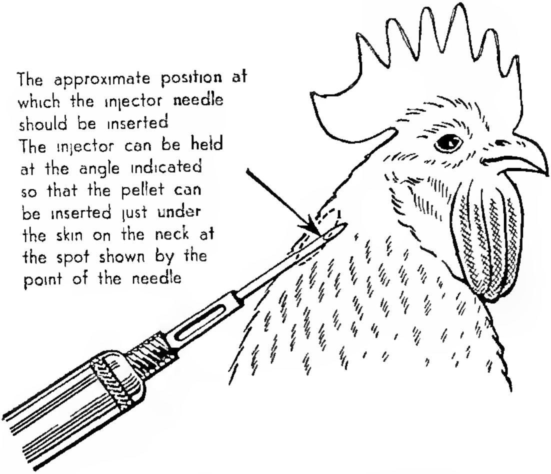


Fig 174. Chemical caponizing by means of injection with hormone pellets. (Some operators prefer use of injector at opposite angle The injector is then held near the comb of the bird)

drug be implanted at this point so that any unabsorbed residue is discarded with the head when the bird is slaughtered Give the injection not later than four weeks before marketing, both from economy and residue angles This prevents possibility of consumption with the meat Poultry treated with pellets or paste have been considered perfectly safe for human consumption The use of the hormone in feed is not advised in view of varying rates of consumption The use of implantation of pellets or paste by an injector has been the only method of using the hormone recommended by veterinary authorities Injectors are not costly—the small single-pellet types are quite efficient, and pellets have sold at a cost of about 3c or 4c each Automatic types can be obtained which carry a considerable number with a repeater action The economics of this practice has been mentioned earlier It has appeal by virtue of the simplicity of operation and improvement in the quality of the birds marketed * (See references pp 486 and 514 for need to check for latest ruling on use of this practice)

* Where pullets and cockerels are being raised together for market the pullets can be injected also when doing the cockerels. This gives a gain in weight and carcass quality as with cockerels This is common practice in California, where "fryers" are injected at eight to nine weeks and carried to "caponette" stage, being sold at about thirteen to sixteen weeks

DRESSING OF POULTRY

The normal avenue of sale is on a live-weight basis to auction abattoirs contract buyers, or consumers, but for the benefit of those who may wish to dress some birds on the unit some suggestions are given These are described for killing, dry plucking, and dressing for table and export by D Hart of South Australia, who was responsible for the display shown of all types of dressed poultry Semi scalding, hard scalding and plucking methods described are from "Table Poultry", by V H Brann and F H Hart of New South Wales

Specialist operations requiring considerable skill, such as the art of boning a chicken, wax dressing, packaging in plastic bags, and the cutting up of young poultry into the various parts of cut-up chicken for sale (according to the particular portion of poultry desired) are not covered, as these are outside the scope of a general husbandry publication

HOW TO DRESS POULTRY

"*Killing* Birds, which should be in good condition, should be without food, being fasted for eighteen to twenty-four hours, with only water to drink, so that the crop and digestive organs may be empty before killing This also improves the flesh

"Of all the methods of killing, none is so clean and satisfactory as dislocation of the neck, when it is done properly, this is the plan followed by many poulterers Take hold of the bird by the legs and wings with one hand, then with the other hand you take hold of the back of the head by placing it between your thumb and first finger, then close your hand on the head and at the same time put your little finger under the bottom of the beak of the bird, (this acts as a lever), and bend the head well back, and at the same time give a sharp pull, which will dislocate the neck Be careful with young birds or you may pull the head off The bird should then be held or hung with the head downwards, so that the blood from the body will drain into the head and neck

"Another method of killing, which requires a proper knife and practice, is to take the bird by the feet or shanks and wings, stun it with a sharp tap on the head (a stick can be used), open the bird's mouth, and sever the jugular vein of the neck, then push a sharp pointed knife through the roof of the bird's mouth into the brain, and after this hold the bird with head down so that the blood will drain out Be careful when killing by sticking, as you may get a soft skull bird, which makes it possible to put the point of the knife through into your own hand The flesh of bled birds is much better in colour than that of the birds which are not bled by sticking

"*Dry plucking poultry* The bird should be suspended with both legs apart for ease of plucking (also with wet plucking) This operation should be commenced immediately after killing, as the feathers come off readily (particularly after sticking a bird) when the body is warm It is a long and difficult operation for the beginner A skilled operator will remove the feathers from a bird in a few minutes Care must be taken not to tear the

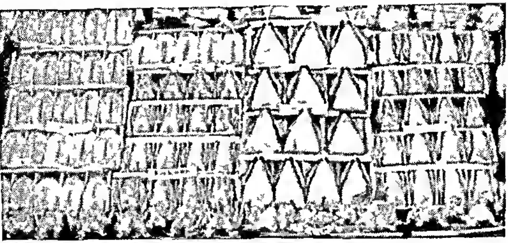


Fig. 175. Attractive display of well-grown poultry. From left the main groups of dressed birds are: Muscovy drakelings, cockerels from Malay Game males crossed with Rhode Island Red hens, and pure-bred Rhode Island Red cockerels. Centre display shows dressed Bronzewing turkey gobblers, and Light Sussex dressed cockerels to the right. The exhibit was staged by Dave Hart of South Australia.

skin, as torn skin spoils the appearance. The skill in plucking must be acquired by experience.

"When the feathers are off, the birds should be singed to burn off the fine fluff and hair that is left on after all the feathers have been removed. The body should be put over the flame of fire quickly, to prevent scorching the skin, after which the bird can be dressed.* When plucking the bird the large feathers can be disposed of. The small feathers can be put into an open texture hessian bag and hung out in the air to dry in fine weather. If the weather is damp they can be hung up in the shed or artificial drying methods used, and when dry can be used or sold for making pillows, etc.

"*Dressing poultry for the home table after plucking:* Poultry for home use can be dressed as follows: First start by drawing the sinews. To do this you place the bird on its back, and with a sharp knife you cut the leg just below the front of foot; then bend the foot back, and the leg will break. Get a piece of rope or wire, and make a loop, and fix it to a post; then put the foot that has been broken into the loop, and pull hard, and the foot and sinews will leave the leg and the legs will be as tender as the breast. Then with a sharp knife cut the skin at the back of the neck, and cut the neck and head off, then take the crop out, and cut around the fork of the neck to loosen the sinews or small arteries that hold the heart, then to make sure you have cut them, put your finger in and turn it around to loosen any that have not been cut.

"You then hold the bird in such a way that the breast and neck will be resting on the table. Then with a sharp knife make an incision just between

* Large processing plants with specialized operation techniques use mechanical methods. These plucking machines have "rubber fingers" which rotate, and the birds after immersion in a scalder, are held against them—or the centre may rotate with birds and the fingers be attached to the inside edge of a drum-type machine.

Note: For design of a simple type of dressing room, and points on the equipment needed, see Appendix 6.

the tail and the vent, then put your finger in and pull out the intestine joining on to the vent, and cut it off Then put your finger in and loosen the fat joining the gizzard and the breastbone When this is done pull the gizzard, and all the inside organs should come out together Sometimes there are little pieces left inside which have to be removed After drawing the bird, the giblets* can be cleaned and used separately (or placed back inside the bird if being sold) The bird can then be trussed ready for cooking A simple method of trussing is to pass a string (about 30 inches in length) round the shoulders, alongside the body on the inside of the legs, then draw it tightly and tie securely at the end of the legs, then draw it tightly and tie securely at the end of the breastbone Taking an end of the string in each hand, pass it over the legs, then cross underneath and draw the legs down by fastening the string tightly around the tail The last wing joint is then twisted around so that the wings lie flat on the back of the bird The bird is then ready for the oven

"*Poultry for export* Poultry dressed for export are killed by pushing a sharp pointed knife through the roof of the bird's mouth into the brain, and held head down so that it will bleed well, and show a good colour Then they are plucked clean, only leaving a few feathers on the head and neck They are not singed, and not cut anywhere to draw them, only the intestines are drawn out through the vent leaving the gizzard, liver and heart inside The head and feet are washed clean, and left on the bird, the feet and legs are tied down close to the body, the head is wrapped in greaseproof paper, and when packed in boxes each bird has greaseproof paper between it and the next one

"They are then nailed up, and then quickly put into cold storage until shipped "

WET PLUCKING OR SEMI AND HARD SCALDING METHODS

"*Semi scalding* The temperature of the water should be kept at 120°F to 140°F for semi scalding The birds should be immersed for 30 to 45 seconds according to their age, being left in the water *only* long enough to loosen the feathers This will enable feathers to be removed without much risk of tearing the skin (If being stored birds should be chilled and dried as soon as possible after dressing)

"*Hard scalding* The temperature of the water, which should be sufficient to completely submerge the birds, should be held at 160°F to 180°F for hard scalding (The older the bird the higher the temperature) Dip the birds only long enough ($\frac{1}{2}$ to $\frac{3}{4}$ minute) to enable the feathers to be removed easily The hocks are the last portion to go in the water, and withdraw the bird immediately the feathers at this joint will pull easily Hard scalding should only be used for birds to be eaten quickly after dressing as the high temperature dissolves fat under the skin and gives a poorer appearance than with other methods of dressing Be careful not to tear the skin as it is tender after hard scalding

* The giblets consist of the heart, liver, gizzard, and the cut off portion of the neck

"*Plucking*. The bird is suspended by the legs as mentioned for dry plucking (p 519) A suitable method of plucking is to encircle each leg with thumb and forefinger and then rub off the feathers with a downward rubbing movement to the shoulders Then grasp the neck in the right hand, the left being placed on the underside near the shoulder to prevent tearing while removing neck feathers with the right hand The tail feathers are grasped tightly as low as possible and with a quick clockwise motion are removed in one action Insert four fingers of the right hand between the legs with the palm downwards, reach up above the vent Then pull with a downward pressure to the end of the breastbone to remove the feathers This completes plucking except for the wings Grasp the wing in the left hand close to the body and with the right hand grasp all the long feathers and remove with one pull Then place the right hand around the wing (the left is immediately above, holding the flesh to prevent tearing) and draw it down the wing, removing the feathers The other wing is done in the same way These actions rub rather than pluck the feathers Any feathers remaining should be removed by slapping with the hand after the bird is taken from the hook Any hair can be removed by passing the bird over a flame"

Note It is indicated that specialization has entered the sphere of poultry processing Efficient large scale processing plants with mechanized operation (also some efficient small mechanized units) have reduced costs by large turnover, and present attractive packaged dressed poultry with marked consumer appeal

SIZES OF BOXES OR CRATES FOR TRANSPORT OF POULTRY OF ALL AGES

Sizes given will comply with most of the regulations imposed for sending birds to customers or to market by speedy means within Australia (Sending adult birds outside Australia would not be covered by crates of these dimensions—larger crates would be necessary Contact should be made with State authorities)

POINTS FOR CHECKING

In day-old chicken boxes no provision is made for food or water as this is not necessary. Chickens should arrive at their destination within forty-eight hours of hatching, and turkey poults within twenty-four hours Fine wood wool is a suitable material for the bottom of chicken boxes They should not be boxed for a long time before dispatch Care is necessary in travelling that they are not too hot or too cold (See also pp 123-4)

Month-old chickens in boxes should be sent quickly to their destination, particularly in hot weather. They should travel within the day if possible. Chaff or chaffed straw can be used in the bottom of the box

Adult stock of all types should be provided with water tins, and the floor of the crates covered with straw or a similar material Do not have more than twenty-four birds in any compartment if possible, and preferably twelve. Ducks in particular are very nervous The tops should be slatted or netted—and do not allow more than one inch between the slats on top or birds may put their heads through and have them cut off by another crate.

Also the sides must have openings between each board or be netted or hessian or the air could be cut off by a box being placed on top of a crate with solid sides and open at the top only The floor should be solid to hold the straw or material used and avoid damaging the feet of the bird Observing these precautions will not only avoid cruelty to stock, but ensure that they should all arrive alive in good condition at their destination (Dead birds received at a market are not paid for) The maximum number of birds for a given size box or crate is suggested as follows

Day old chickens 100 in a standard chicken box approximately 24 ins by 18 ins by $4\frac{1}{2}$ ins high with 25 to each inner circle (With turkey poults only 15 per circle) Ventilation holes are usually provided at the rate of 20 half inch holes per box with 14 in the lid (Usually of 24 oz cardboard)

Month old chickens 24 in a box approximately 24 ins by 12 ins by 7 ins high with one division inside Ventilation holes usually provided 16 in box and 48 in the lid

Three month-old stock 12 in a flat top crate 21 ins by 21 ins by $14\frac{1}{2}$ ins high, 24 in a flat top crate 36 ins by 21 ins by $14\frac{1}{2}$ ins high Approximately $\frac{1}{4}$ square foot per bird

Adult stock One or two birds in a crate of dimensions 21 ins by 15 ins by 18 ins —one if made gable-shaped and two if a flat top crate (usually covered with hessian for this type), 12 hens or ducks in a crate 45 ins by 21 ins by 18 ins high, 24 hens or ducks in a crate 48 ins by 30 ins by 18 ins high This allows approximately $\frac{1}{2}$ square foot per bird

If drakes or fully grown roosters are being sent, reduce the number for these crates to eight and sixteen respectively allowing approximately $\frac{3}{4}$ square foot per bird (For ducks see also p 571)

Geese and turkeys 1 bird, crate 21 ins by 15 ins by 30 ins high, 2 birds, crate 30 ins by 15 ins by 30 ins high A crate 48 ins by 30 ins by 30 ins high (10 square feet) is suggested for ten young turkey hens or young geese at marketing stage or eight young gobblers or ganders at the same stage Use this crate for six adult fully grown geese or ganders or turkey hens With fully-grown adult turkey gobblers it is not advised that more than four or five be placed in a crate of this size (Ranges from $1\frac{1}{2}$ to $2\frac{1}{2}$ square feet for turkeys)

Note It must be remembered with the crating of all classes of poultry that appearance as well as condition brings the best prices They should be graded for size in the various crates

Birds suffocate easily and when crowded together they become damp and feathers lose sheen and become soiled Hence, do not overcrowd—observe the measurements listed—also the floor covering—and water tin provided where it is secure and can be easily filled on the way to market Birds deprived of water on a long journey arrive in dry condition and weight is lost

Success in rearing and feeding and producing a quality bird can be spoilt at the last owing to lack of care Avoid marketing under heat-wave conditions if possible Birds opening up in poor condition (plus possibly deaths due to overcrowding) can seriously reduce returns

SUMMARY

1 Table poultry production has become big business in the Australian poultry industry, with estimated $60,000,000 values Marked progress has been made with specialized efficient techniques in breeding, feeding, management and processing methods Meat line chickens have now approached economic parity with crossbred cockerels to make possible full year operation Expansion possibilities for further growth are linked with comparative prices for red meat, carcass attractiveness, and efficient marketing

2 The basic requirement for efficiency in table-poultry production is the lowest level possible for the feed to meat conversion ratio This is set out for twelve, sixteen and twenty-four weeks of age on a reasonable efficiency basis It will be decided by feed ration efficiency, genetic background of stock used, and management

3 The most economical marketing period when efficient methods are used is the nine- to twelve-week ("broiler") stage, to give highest return for labour and capital used, when birds weigh about 3 lb. live weight It is possible to market profitably with a lower price per pound for meat than for the limited twenty-four-week stage

4 The adoption of a particular system of rearing will be governed by the land and facilities available Three systems are described covering intensive rearing on deep litter, battery-cage rearing and free-range rearing The intensive-floor system is the most widely used, labour saving and efficient for the early marketing "griller" or "broiler" stages, and the most economical system for the later marketing stages could be the free-range system Space needs and procedures are listed

5 The use of high-energy rations, of basic or special types, correctly balanced for all requirements as set out in the text will make possible very good growth for a minimum quantity and/or cost of feed, and must be combined with sound management and ample room for floor, feed and water space to produce quality birds

6 The production of capons can be undertaken for limited markets, and caponettes may have a place in meat-raising practice

7 Sideline table-poultry units can be an economic factor on general farms, and possibly on some commercial egg-production farms

8 The dressing of poultry may be necessary for certain markets, and this should be carried out carefully Specialized plants provide facilities for the industry When marketing live poultry observe the requirements listed A small dressing unit is shown in Appendix 6

9. The economics of table production for various marketing ages can be checked from examples given Adjustment can be made on the basis shown for ruling prices for feed and meat The margins can be assessed by growers for contract basis or individual operation on lines discussed Broiler output of 30,000 to 50,000 annually per operator appears practicable. Returns will be governed by the operator's plant layout and efficiency of operation with a considerable volume of turnover.

For further reading on "griller" or "broiler" raising practices the following references are suggested as desirable for those who are specializing in meat production

"The Broiler Industry in Australia" by Bruce E Bartlett, Victoria Department of Agriculture Journal, August 1961, pp 407-12 Review of industry costs, overseas comparisons and industry trends

"The Australian Broiler Industry" by F Skaller, Journal of Australian Institute of Agricultural Science, September 1961, pp 145-50 Discussion covering industry possibilities, costs breakdown and breeding potential

"Broiler Growing"—New South Wales Department of Agriculture, Division of Animal Industry publication (Sixth Edition 1960) A 22 page publication covering systems, husbandry methods, and dressing birds for New South Wales conditions

Queensland Department of Agriculture and Stock, Division of Marketing Annual Reports covering poultry meat statistics Very useful references with complete data on poultry meat production in Queensland

"Killing and Processing", Extract from Table Chickens Bulletin 168, Ministry of Agriculture, Fisheries and Food, London, England A very useful reference for processors

"Broiler Production and Management" by A O Moll, Secretary, W P S A , Australian Branch Address at Twelfth Annual Poultry Farmers Refresher Course, 1965, Massey Agricultural College, University of New Zealand Reference on recent practices, increase in production, and contract basis

"Controlled Environment Broiler Houses in Western Australia" by D F Hessels, West Australia Journal of Agriculture, January 1967, pp 22-31

CHAPTER 19

TURKEYS

The turkey-raising industry in Australia is becoming more prominent than in former years Improved practices with hatching, rearing, feeding, and disease control have made possible more efficient production of turkeys It is estimated that half a million are now raised annually Interest has been particularly keen in New South Wales, and the Australian Turkey Federation has been formed

Turkey growers' schools have been conducted at Wagga Agricultural College by the New South Wales Department of Agriculture As the result of such moves turkey production has become more specialized. Artificial incubation, brooding improvements, better-balanced feeding rations, have increased efficiency and improved methods of dressing and attractive presentation of turkeys for sale are factors in increasing returns

As with all lines of table poultry the attractive condition of the dressed birds is a big factor in stimulation of sales—neat dressing of birds, packing in plastic containers, different-sized birds for various market demands, cut-up birds sold in portions, and so on

Where range conditions are suitable and proper methods of management are followed, turkeys can be raised with a relatively small capital outlay in equipment Conditions must be kept sanitary by moving feeders and waterers frequently and the rotational use of well-grassed range This will cut feed costs and also destroy weeds and injurious insects Turkeys can be a worthwhile feature, and a pleasing sight, in farm programmes, or be run as a specialized commercial venture Good management is approximately three-quarters of the success story in running turkeys

TURKEY BREEDS

The main breed available in Australia is the Bronzewing The emphasis in Australia from a commercial viewpoint has been on a medium-sized Bronzewing, which suits market requirements better The late G W Smith, of Wagga Agricultural College, who was well known for his work with turkeys, has stated the object of breeding is a bird of "blocky" type with broad breast and a little lower on the legs than usual on bronze turkeys in Australia—these characteristics to be combined with quick maturity and prime breast fleshing qualities

This Australian standard follows closely the American Broad-breasted Bronze Both in America and here this breed predominates although interest is evident in "White". In America a second breed has become popular—the Beltsville Small White, which, although small, is an especially well-meated bird, in demand for small family requirements The main field lies here—the oversized bird has a limited market and is

more difficult to rear Also the fertility, and hatchability, of the medium-sized turkey is better Interest in small "White" is now evident here

The other principal breeds are White Holland, Black Norfolk, and Bourbon Red

BREED STANDARD FOR BRONZEWING

The standard for one breed only—Bronzewing—will be given as these comprise the major portion of stock raised

General Characteristics

Head—long, broad, and covered with fleshy protuberances (caruncula-tions)

Beak—strong, curved, and well set

Eyes—bright and bold

Neck—long and curved back when strutting and the top and most of the front covered with carunculations

Body—long, deep through the centre, and well rounded, broad full breast The cock's beard long, bristly, and prominent

Back—curving somewhat, rising from the neck to the centre and descending in a graceful slope to the tail

Wings—large and powerful, carried well up and close to the side, long and drooping tail nearly touching the ground

Legs—should be straight, fairly long with large and strong shanks

Four toes—straight and strong, well spread

Carriage—stately and upright

Plumage—hard and glossy with short fluff

The weights mentioned are those of the English standard, but the American standards are given in brackets alongside, and these would appear to be the type of standards more suited to Australia

Weights

Cock 30 lb to 50 lb	(adult tom 36 lb)
Cockerel 25 lb to 35 lb	(yearling gobbler 33 lb) (young gobbler 25 lb)
Hen 18 lb to 26 lb	(adult hen 20 lb) (yearling hen 18 lb)
Pullet 14 lb to 22 lb	(young hen 16 lb)

Note The standard does not lay down the age at which these weights should be reached, but maturity is generally regarded at eight to nine months of age

Colour—Male

The plumage on the upper breast and neck is a black base with a surface colouring of iridescent red green bronzing The lower breast and wings are similar to the former markings except for the addition of an edging of velvety black and red-green bronzing The tail when spread for strutting

shows perfect feather formation—the exposed portion being black with evenly pencilled narrow strips of brown until near the tip of the tail, where there is a broad band of brilliant copper which is bordered front and rear with black The tips have a wide edge of white which forms the outer edge of a perfect fan, this white band being duplicated half way towards the base of the tail

Colour—Female

The plumage of the female is similar to that of the male in main characteristics except for an edging of white on feathers of wings and breast

Picking the sexes is easy after the birds have grown their true feathers, the pullet breast barring being particularly distinct against the male black bronze markings

Head Colour (both sexes)

Beak—horn

Eyes—dark hazel iris and blue black pupil

Head (including face, jaws, throat, wattle, and caruncles)—brilliant red, changeable to blue-white

Legs and feet—black or horn, some strains showing a distinct pink colour in both legs and feet

SCALE OF POINTS

Type	25	Serious defects
Weight	25	Wry tail,
Colour	20	crooked breastbone,
Head, neck, and wattle	15	any other deformity
Legs and feet	10	
Condition	5	
	100	

Note The breed standard and general characteristics are from ' Turkey Raising ' by G W Smith, Livestock Officer, Poultry, G L McClymont, Special Veterinary Research Officer, D G Christie, Veterinary Officer, and I G Pearson, Veterinary Research Officer, issued by the New South Wales Department of Agriculture

It is also suggested by the above officers "that Agricultural Societies should foster turkey sections to include export quality classes judged on breast and leg fleshing together with finish, skeletal development, and suitable export weight To be used with a system of selection score carding each entry, and that it is overdue as compared with judging mainly on feather colouring and large size With this is coupled the suggestion of class for 'export pair' (pullet and cockerel) dressed and judged for export It is suggested that this would be of considerable interest not only to breeders, but would help in educating the public by the visual demonstration of prime dressed birds displayed in refrigeration cabinets at the shows "

TURKEY-RAISING SYSTEMS

The bulk of turkeys produced come from general farms where turkeys are handled as a sideline Turkeys fit in with the farm programme, as they can be used to clear noxious weeds such as saffron thistle (which is a good feed for turkeys), and also keep down grasshoppers They also do well on stubble, picking up waste grain They have also been reported as a control for bracken, fern, and blackberries

Many of these sideline units have raised their own stock, but with the advance of specialization in the turkey industry, the sale of day-old or started poults is becoming established This means that the desired supply of stock can be obtained from these centres This is more efficient, as it considerably reduces labour, bringing operations more in line with overseas practice

Commercial turkey-farmers operate with either range or intensive methods Where adequate safe, cheap range is available it is very economical, as feed costs are approximately 15 to 20 per cent less than with intensive raising This is a substantial saving, as feed costs comprise about 60 per cent of costs in raising turkeys Labour can also be saved by allowing the turkeys to harvest their own grain where crops are grown for this purpose They can also graze their own greenfeed requirements on suitable pastures

Exponents of intensive rearing can claim the factors of less mortality from disease, and that no losses are experienced from foxes and eagles Panic can be controlled more easily and protection from adverse weather is possible They also claim that a better quality of flesh is obtained, also labour of feeding and attention is reduced, and that these points balance the heavier feed consumption

The adoption of one system or the other can be decided by the area, soil type, and cost of the land available, as compared with the cost of materials for intensive-rearing quarters, and the labour factor being reduced with intensive units The factors of natural enemies such as foxes and eagles, and availability of good pastures will need to be considered The question of prevailing weather conditions in the area will be a factor—in damp areas with limited fresh land available and farms close together, the intensive method would have the greater appeal In some districts of mountainous nature free range would not be practicable In sparsely populated areas, with low to reasonable rainfall, ranging of turkeys would be thought the best proposition Irrigated areas can supply sufficient greenfeed in dry areas or lucerne meal and vitamin A substitutes be used—but the emphasis is on greenfeed if practicable with range conditions

HUSBANDRY VARIATIONS IN RAISING TURKEYS AS COMPARED WITH CHICKENS

Some people commencing to run a few turkeys may think they can handle them like poultry, but this is not likely to give very satisfactory results

An increased brooding space for poults as compared with chickens is needed More care must be taken if poults are running outside from their

brooder, as they are not as self-reliant as chickens in relation to "coming out of the rain" and also they should not be allowed out in long, wet grass The feeding must be on a higher protein level than for poultry

Turkeys grow rapidly and an ordinary chicken mash would not be suitable to maintain maximum growth Increased room should be available at all stages as compared with poultry Poults will need coaxing to eat at first to a much greater extent than chickens

A bright light is necessary on the feed, also coloured marbles are sometimes placed on the feed and in the water, as poults are attracted by bright objects Feed can be scattered on paper—care is necessary to start them all feeding Also finely chaffed greenfeed can be sprinkled over the mash in the troughs They are very prone to panic at all ages and this must be carefully guarded against or heavy losses can occur They will not travel far to water—this must be available at several convenient spots—and they will fret if closed in after being on range They are subject to a number of complaints if husbandry and sanitation are not good—waterers and feeders should be moved frequently to fresh ground or be surrounded by slatted or wire-netting-covered frames It is also advisable to have roosts set around a floor brooder at an early stage (with wire-netting underneath) so that the poults are trained to roost much earlier than chickens because of their characteristic of going up in a corner if anything should cause them to panic

STOCKING THE TURKEY UNIT

The method suggested as best for a person desiring to handle turkeys as a straight rearing proposition for market is the purchase of day-old or started poults from the breeding or hatchery centre Where stock is retained for breeding purposes the following basis is suggested

SELECTION OF BREEDING STOCK

Males and females to be selected on the basis of the standards suggested earlier in the chapter, and should be vigorous, well fleshed and possessed of straight keel bones It is important to use the following basis They should be the early-hatched best-grown birds—*with best body weight at market time desired*—for breeders Select on body weight—a highly heritable factor in breeding for meat. They must also be free of any signs of pendulous crop or deformed legs Provided that both gobblers and hens are early hatched, fully matured, and well grown they can be used in their first year as breeders Ten to fifteen hens can be allowed for each gobbler

A well-known turkey breeder, Don Thomas of Tasmania, who has raised some of the largest flocks in the Commonwealth, used this practice He bred from the best of the preceding season's stock each year, employing careful selection Fertility and hatchability are better with young stock, which is desirable when producing for meat

The aim should be to get as many eggs as possible during the early part of the season to have well grown turkeys for the Christmas trade Nests should be provided to prevent the loss of eggs laid out in the open

due to breakages and the taking of eggs by crows Early hatching of poults is needed to breed for the Christmas trade, and artificial lighting for the breeders will help the supply of eggs

LIGHTING OF BREEDERS

The feeding of turkey breeders needs to be on a protein level as for laying hens (15 per cent protein overall ration) in order to bring them into production early Early production will be accelerated by the use of artificial lights This should be commenced four or five weeks before a good supply of eggs is required, that is, a production approaching 50 per cent, which means using lights in March-April or the beginning of May in Australia

The suggested illumination is on the basis of a 75-watt lamp for an area of 200 to 250 square feet The height of the lamp should be 6 to 8 feet above the ground whether in a shed or in the open A metal reflector should be used in both cases and a strong wire grille should surround the globe for protection (Note that the rate of light is nearly double that for hens)

It is suggested that the lights should be on for the males two or three weeks earlier than for the layers, but where conditions are mild this may not be necessary The daily period of lighting should be approximately

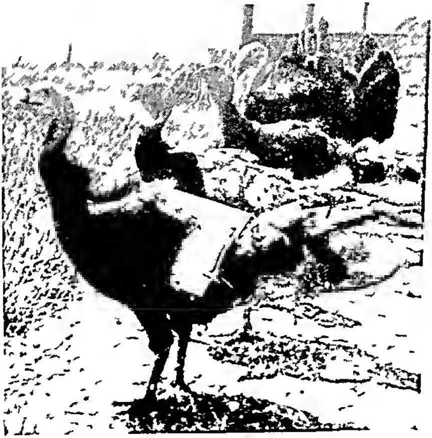


Fig 176 Mammoth Bronzewing turkey hens and gobbler The hen in foreground has a canvas saddle attached sometimes used with heavy gobblers The use of these calls for care in hot weather, and also they may harbour lice

fourteen hours, as with laying hens, and the time schedule must be carefully maintained This means lighting from 4 a m or 4 30 a m A time switch is needed to switch the lights on (if not possible give one-quarter intensity all night) Gradually taper off the hours of lighting when spring days extend in August or September by bringing on the lights half an hour later for two or three weeks, then repeat this adjustment and by that time it could be discontinued This same gradual process can be used when starting the lights—take three or four weeks to build up to the time stated above (see schedule given for hens in Chapter 17)

This practice is an efficiency move to breed for the popular Christmas market Where electric power is not available other means of illumination can be used such as storm lanterns (all night use as above)

SPECIAL CARE FOR BREEDERS

Where heavy gobblers are used it may be necessary to fit a canvas saddle to the back of the turkey hens, but with medium-weight males and spurs trimmed this should not be necessary (A number of operators do not like saddles, as they can cause heating and also can be a harbour for vermin such as lice) Under good conditions of careful management and feeding, 40 to 50 eggs could be expected from first-laying season birds with a reduction of eight to nine eggs each season thereafter Feeding should be on a good breeding ration as set out in the feeding section of this chapter

ARTIFICIAL INSEMINATION OF TURKEYS

The use of artificial insemination has been suggested as having marked possibilities in turkey production It is stated that 100 hens could be inseminated from one turkey gobbler The technique is described as first used in the United States* by Burrows and Quinn

A detailed description is not thought necessary in a book of general husbandry, as this procedure would be used mainly on very large plants Interested producers are recommended to refer to "Turkey Raising", the New South Wales Department of Agriculture publication referred to previously in this chapter

HANDLING ADULT STOCK ON RANGE

Handling of stock being retained as breeders does not usually present many problems They are ranged on an area not to be used by young stock, and will not at this stage need any type of shedding Roosts in the open will suffice, but endeavour to place them fairly close together for storm protection and in the shelter of trees for protection against prevailing winds In general a location on the sheltered side of a belt of trees or a convenient hedge may be advisable An arrangement of roosts that gives good results is to use $2\frac{1}{2}$-inch diameter poles or 3-inch by 2-inch timbers These roosts can be placed about 2 feet apart A slight rise in the roosts

* This practice is popular in the United States, and has given reliable results It also makes possible crossing of a small and large breed as desired, which would be difficult without this for turkey breeding

is popular, rising about 1 foot in 4 feet, starting about 12 inches from the ground Others report excellent results with roosts on a level only 12 inches above the ground These roosts are best constructed on skids so that they can be pulled from one area to another (Breeding can also be successfully carried out under intensive conditions)

Feeding of breeders, like rearing of young stock, can be carried out with the minimum of purchased feed being required, when good range is available (Savings from 15 to 40 per cent have been made on purchased feed as compared with intensive housing when on excellent pasture and planted crops) The same rule of moving roosts, feed, and water around the range should be observed to prevent disease problems due to contaminated areas

Single nests for breeding hens to prevent crowding should be about 16 inches by 20 inches and about 20 inches high with the front opening 8 inches by 9 inches

Group nests can be made 2 feet wide by 8 feet long by 20 inches high with lean to roof The front open except for lower 8 inches Back and sides solid except for 4 inch ventilation board under roof at back for hot weather These can be placed on the ground—straw or shavings will act as nesting material A nest this size can serve for up to 50 hens Broody coops will probably be necessary Wire-netting or slatted floors are needed Four days in the broody coop will usually be sufficient to control broodiness—in sight of the gobblers and other hens Provide about 4 to 5 square feet per hen in the coops Unless broodies are thus treated many eggs can be lost—isolate broodies promptly as noticed

Egg collection Eggs must be collected frequently—four times daily—to prevent breakages and avoid encouraging broodiness Search for any hidden nests on the range

INCUBATION OF TURKEY EGGS

HANDLING OF EGGS

Collect daily and do not hold over seven to ten days The eggs should be stored carefully, not in a draught They can be turned daily by hand (if being held on a tray over a week), if in a case the case could be set with the opposite end raised up on alternate days

The humidity should be fairly high (70 to 80 per cent) in the room and temperature about 55°F to 60°F The eggs should weigh 2¾ to 3¼ oz and be of good size and texture Care taken in holding the eggs will have a marked influence on the hatching results Also the feed given to the laying turkey hens will govern the early rearing results of the young poults

NATURAL INCUBATION OF TURKEY EGGS

Natural incubation methods with turkey eggs are successful, but have certain disadvantages It is necessary to wait until the turkey hens go broody, this can mean a loss of eggs if no broodies are available, and also seriously restricts operations Also if a broody hen is used for this purpose and also possibly for rearing the poults as well, then very few eggs are

obtained from a turkey hen in a season Also disease can be transmitted by hens to poults, and lice must be watched closely

If turkey hens are to be used, then it is advisable to collect eggs and try to arrange for more than one to be set at a time—then the poults can be shared up to release as many as possible for laying again For example, one hen could take over all the poults when two hatch together This also prevents having too many lots of turkeys of varying ages, which makes rearing and marketing difficult

Suitable nests are required These should be flat and shallow The soil should be damp underneath with just a little straw added One operator arranged to have thin thatched roofs to setting pens, which allowed winter rains to go through, but gave shade to setting hens in the spring This greatly assisted the supply of necessary moisture for incubation of turkey eggs A system incorporating small pens gives good results A setting pen (wire netting sides only and a thin thatched cover over the top) 4 feet long by 4 feet wide by 4 feet high accommodates two setting hens They can be moved without upsetting them as broodies Others have used half of an old tank with some branches in front with good results Setting hens should have water available at all times and feed can consist of mixed grains and greenfeed Care should be taken to dust the hen with an insecticide to control lice, or the insecticide can be put in the nest If several hens are set together testing of eggs at seven days will enable eggs to be moved up under fewer hens and some more turkeys are available to set again

Some operators combine natural and artificial incubation by either setting in an incubator until sufficient hens are available for transfer of eggs (usually adopted with a small incubator only) or transferring eggs from setting hens to incubators three days before hatching, and then giving each hen about twenty poults after hatching This is done in an endeavour to avoid the mortality that often occurs through turkey hens trampling chicks after one or two have hatched Care must also be taken to see that turkey hens rearing young poults do not take them into long wet grass or many will be lost

Natural incubation has limitations, and artificial incubation is adapted to large-scale operations

For sideline units running a few turkeys only it can be a means of saving labour with hatching and rearing if good setting hens are available, and can fit in quite well in this sphere

ARTIFICIAL INCUBATION

The expansion of the turkey industry needed means of producing numbers other than by natural incubation methods Techniques were evolved for artificial incubation as with hen eggs, and very successful results can be attained The main variations for turkey eggs involve only a slight temperature adjustment and the provision of a higher humidity level

Reference has been made in Chapter 9 on Incubation to the artificial hatching of turkey eggs The rules in relation to suitable machines and room for incubators would be as described for hen eggs The general technique for attention to the machine would be as for hen eggs.

The main points for checking are·

Temperature—$99\frac{1}{2}$°F in forced-draught machines with thermometer in position as for hen eggs In some machines with separate hatching chamber run a degree lower for last four days In small still-air machines 102°F with the thermometer bulb nearly level with the top of the eggs namely $1\frac{7}{8}$ to 2 inches above the floor of the tray (This can be altered to 101°F for first two weeks, 102°F third week, and 103°F fourth week)

Turning—At least three times daily up to 24 days in automatic machines —turning more frequently is desirable Twice daily has been successful in small still-air machines

Testing—Approximately ninth day and twenty-third to twenty-fourth day when transferring to hatching trays Development to be looked for as for hen eggs

Cooling—Not necessary in forced-draught machines—in small still-air machines cooling may be necessary for the supply of fresh air, but only leave out a little while and replace while lukewarm to touch While cooling, exchange eggs from corners of tray with those in the centre

Humidity—For forced-draught machines 55 to 60 per cent humidity for 24 days, then 70 per cent for last four days (Readings on wet-bulb thermometer could be 85°F to 87°F for 24 days and $90\frac{1}{2}$°F for last four days) In small still-air machines higher wet-bulb readings are used The readings would be approximately 89°F for 24 days and 92°F to 93°F for final four days As for hen eggs obtain humidity by extra trays of water.

Hatching care—Have coarse hessian or similar material on hatching-tray floor to prevent leg injury by poults slipping over Also have the *compartment quite dark—if no solid door provided in front of glass,* hang a curtain or shield of some sort Poults cannot be held in chicken boxes as long as hen chickens—only up to 24 hours after hatching Put 15 poults where 25 hen chickens could be placed in a chicken box

A suggested reference covering technique and causes of failure to obtain good results with incubation of turkey eggs is an article on "Incubation of Turkey Eggs in Australia", by A O Moll, formerly Secretary, Australian Turkey Federation

SUPPLY OF EGGS FOR INCUBATION AT RIGHT TIME GOVERNS MARKET RETURNS

Labour will be saved by having big hatches of turkeys Numerous small hatches mean far too much work with brooding and rearing As many eggs as possible should be set in each lot, hatching once a week rather than twice The earlier the eggs can be obtained in the season the better from a marketing viewpoint where the Christmas market is the main outlet (although cold storage facilities can be a big factor in altering this aspect)

Artificial lighting has been dealt with earlier in this chapter This will have a big bearing on adjusting the hatching season Hatching after October will not be expected to give good results, as growth rates with

poults (also hen chickens) are much slower in the hot weather Early hatchings such as July and August can make maturity and weight a month or two faster than the late hatchings—this reduces the cost of feeding and labour time

REARING POULTS—NATURAL AND ARTIFICIAL METHODS

REARING WITH TURKEY HENS

This method is used to raise small flocks and permits advantage being taken of free-range conditions

Care must be taken to use healthy hens and keep them free of parasites However, the danger of disease transfer is present Losses may be experienced with storms and also from hawks, eagles, and foxes if the hen roams too far with the poults

Approximately 20 poults can be given to one hen A suggested small coop is one 5 feet long by 3 feet wide by 3 feet high with a weatherproof roof but only half-length weatherproof sides and for the balance netting can be used A wire-mesh floor is advisable The hen and poults can be confined with feed and water for a day or so and then the poults can be let out, except in stormy weather or into long, wet grass This can be followed by the use of an enclosed yard or care be taken with the hen and poults on range until the poults are about eight to twelve weeks old Natural brooding is only suited to small-scale operations unless a very large number of turkeys are available as mothers One operator raised a number of turkey hens and poults together—five hens with one hundred poults—in a large shed with run attached

A safeguard used in this case was an inner circle of 3-inch-mesh netting for the early stages to allow the poults to feed within to avoid being trampled by the hens The inner feeders need to be raised above ground-level, as young poults will not feed at ground-level—a feeder 4 to 6 inches above ground-level is advisable (The feed can be sprinkled with chaffed greenfeed, or coloured marbles used to attract the poults)

The practice of natural brooding can be sound for a sideline unit, but is not usually attempted where a unit of commercial proportions is being handled under present-day conditions—artificial brooding is the rule

ARTIFICIAL BROODING

The use of chicken brooders as described for hen chickens is quite successful, but fewer poults than chickens should be placed in a given area and increased headroom provided

BATTERY BROODERS

Chicken battery brooders can be used, provided they allow at least 12 inches headroom and ⅓ square foot per poult to four weeks Special battery brooders for poults are desirable. Follow-on batteries can be used to eight weeks and then transfer to range shelters can be made. Headroom

needs to be 2 feet at this stage and floor space $\frac{2}{3}$ square foot per poult Some operators use battery brooders for two or three weeks and then transfer to floor brooder systems for gradual hardening-off before going to outside range

The temperature of the battery brooder should start at 95°F to 100°F — and this should be only gradually reduced as the poults grow, because they will panic and pack together with heavy losses if temperatures fall below the necessary level After two weeks as above the temperature is usually reduced about 5°F weekly, but watch the poults as the best guide—adjust to suit their comfort

The room temperature should be kept at 70°F to 75°F It is important that adequate light be concentrated on the feed and water to attract the poults They must feed earlier than chickens—within 24 hours of hatching Brightly coloured marbles or chaffed greenfeed on top of the feed will help, also an extra feeder inside or some feed on a shallow cardboard lid or egg-case flat may help A few poults a week older in with day-old poults will lead them to feed Poults are very touchy in the early stages Ample space must be allowed—the first three days are critical Also for the first five or six days place some hessian or similar material on the wire floor This will give them a good footing, and prevent damage to their feet on the wire mesh (Sufficient space between feeder wires is essential)

FLOOR BROODING

The majority of operators favour floor brooding for turkey-poult raising (particularly where associated with range handling methods) It has the advantage of easier change-over to rearing stage, and less headroom and feeding complications The colony-type brooders, also infra-red brooders described in Chapter 10, are quite suitable for poults Provision should be made to supply heated conditions up to eight weeks if necessary The floor space needed is twice that necessary for chickens A shed 10 feet by 17 feet (as described in Chapter 10) would carry approximately 175 poults up to eight weeks of age without outside run (allowing 1 square foot per poult) and up to 225 ($\frac{3}{4}$ square foot per poult) with a reasonable outside run or sun porch A 400 size hen chick colony brooder or a 3-lamp infra-red brooder would handle this number The idea of the outside sun porch is suggested as advisable, and in keeping with overseas practice It will mean sanitary, disease-free conditions An outside sun porch 10 feet by 8 feet attached to this 10-foot by 17-foot shed makes it possible to carry 225 poults to eight weeks or 150 to 170 to twelve weeks of age Do not exceed these numbers in one lot or in this area for best results

THE SUN PORCH

The sun porch can be of simple construction It can be supported on bricks, as it is used only for a period A frame of 1-inch-mesh netting with suitable cross supports can form the floor and the sides be made of hurdles of 1-inch-mesh netting and light timber Three feet of headroom is desirable (in case they are left to twelve weeks) Covering over the top with another frame (or frames) prevents losses due to cats or hawks—and also

stops poults flying out before transfer to next stage (This cover need only be 2-inch mesh to lower cost) Droppings can be raked out from underneath—a concrete surface makes this very much easier

HANDLING THE BROODER

The same methods of handling as for chickens can apply Restrict the run for a few days by a draughtproof guard or surround, about 2 feet from the brooder Provide ample feeder space Twelve feet of space available one side would be needed as a minimum for 100 poults to eight weeks Water space needs at least one, preferably two automatic waterers for 100 poults—4 to 6 feet of drinking space available would accommodate them to eight weeks (Allow for 4 to 8 gallons daily per 100 to 8 weeks)

Waterers should be on a grill or platform, also the feeder if possible Adequate light is necessary on feed and water The litter material can be as for chickens (Sawdust and shavings are popular for turkeys as litter material)

Note After the surround or guard is taken away at three or four days use it to round off the corners in the shed—poults are more likely to panic than chickens and may go up in the corners Also do not let the temperatures fall below the required mark (95°F to 100°F for first two weeks for the brooder then reduce gradually and maintain 70°F to 75° F in the room)

Feeding It is stressed again, as for the battery brooder, that early feeding within 24 hours of hatching is necessary Refer to the measures as for the battery brooder re use of coloured marbles and greenfeed

EARLY ROOSTING TRAINING ADVISABLE

Poults trained in the brooder stage to roosting are much easier to transfer to range The fewer changes when transferring any stock the better Also try to accustom them to the type of feeders they will have on range before they move The alteration from brooder conditions to outside range is enough without expecting them to roost without some training, and also keep them on the same feed to avoid a double change Roosts can be used in the brooder house (see Fig 177) when poults are about three weeks old Two-inch by 1-inch timber rounded on top is suitable The roosts can start about 6 inches above floor-level (about 1 or 2 feet back from the brooder) and each roost can be a little above the other (about 2 or 3 inches higher and about 10 inches apart) Provide 3 or 4 inches for each poult—50 feet of roosts for 150 poults These can be placed against one or two sides of the shed and it is advisable to have wire-netting tacked under the roosts This can be arranged so that the corners are rounded off For example, in a 10-foot by 17-foot shed, five roosts at the rear of the shed each 10 feet long and 10 inches apart could be carried on bearers 6 feet long starting from ground level and rising to 48 inches high, with netting underneath This would nearly fill up the rear 5 feet of the shed and give adequate roosting space for 150 poults This provision also safeguards against the dangers of smothering and panic, and maintains sanitary conditions

REARING ON OPEN RANGE

Turkeys are usually kept in the brooder house from six to ten weeks according to weather conditions—also whether the range is ready or not can be a factor in deciding time to transfer If conditions are stormy then it may be left till twelve weeks

It is necessary that care be taken to provide conditions that will safeguard against weather extremes Turkeys are cautious and upset when moved out and if a sudden heavy rainstorm or thunderstorm occurred one could have the bad luck to incur heavy losses due to a panic and crowding It is, therefore, very important that some form of portable range shelter be used for the early period of range rearing Also natural shelter is needed (the range shelter can be set against this) on the range for hot weather, and land should be well drained

Moving out about 50 turkeys first on to range—a few nights ahead of the main flock—is a helpful move They can be checked easily and they then act as leaders to the rest of the flock

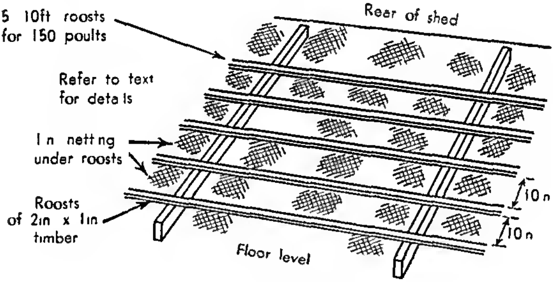


Fig 177 Roosts in turkey brooder shed

SUITABLE RANGE SHELTER

A range shelter need not be elaborate It should provide sufficient space to allow 1 foot of roosting space per young turkey and 20 inches between roosts A shelter with weatherproof roof, 9 feet deep by 12 feet long would take five roosts, 20 inches apart—centre to centre—carried on bearers rising from 1 foot high in front to 2 feet high at back, thus allowing enough for 50 to 60 young turkeys Wire netting underneath or slats should fill in the space between the roosts Height can be 5 feet in front and 4 feet at back Back and sides can be covered, but the shelter can be constructed so that these sides can be removed for hot conditions Front is open but covered with netting to allow closing on account of foxes

Range shelters become less important after the first month or two and open sides should be in order in most localities

FRESH GROUND ESSENTIAL FOR RANGE REARING

Quick growth and freedom from disease can be obtained with turkeys only if they have fresh conditions

Ground should not have been used by adult turkeys or poultry Poultry can transfer diseases to turkeys The area should be well drained and covered with good pasture or crop at the time the turkeys are using it Crops should be arranged to suit this Permanent yarding systems have been used successfully where the feeders and waterers are kept on wire grids or platforms, but this system has hazards not present with the correct use of range

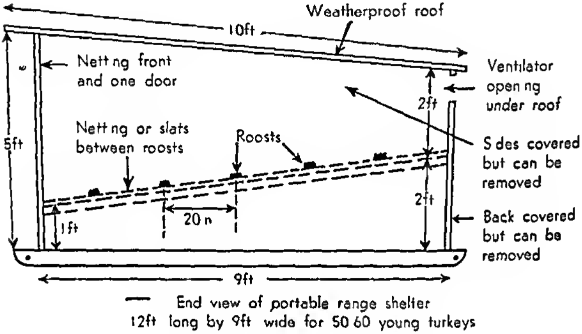


Fig 178 Range shelter for young turkeys

To obtain best results move feeders and waterers, also range shelter, to fresh ground weekly, and keep them well spaced out Where a herding system is adopted and the attendant lives with the turkeys the best use is made of range Under the most favourable conditions of good, light soil and good drainage moves can be made less frequently Area required would be one acre for every 100 turkeys taking it by and large (some cases of 150 to 200 have been successful) An area on this basis of range sections to be used only once in three or four years, will enable an average of about 25 to 50 turkeys per acre of total land to be run on a property, and allow of rotation

Some have operated successfully by means of enclosures This trains birds to a given roosting area and allows of protection against foxes The enclosure is surrounded by a fence 8 to 9 feet high well staked into the ground in addition to being put into a trench about 6 inches deep The netting can be attached to wires at top and bottom of fence Posts should be put inside the netting, offering greater protection against foxes Feed

at the enclosure brings turkeys home for roosting An area of 20 yards by 20 yards would allow enough roosts 3 feet apart and about 1 foot above ground for 250 turkeys when providing 300 to 400 feet of roosting space

PROTECTION AGAINST FOXES

The fence described will offer a considerable measure of security, but may not be sufficient Dogs attached to a long wire by a chain can guard over a considerable distance Lanterns or electric lights are another safeguard.

The electric fence has been used with success by having a wire set 6 to 8 inches above ground-level just outside the fence and if necessary another about 12 inches above the lower wire When turkeys are being moved regularly and open range without fences is used, then night supervision is usually necessary This means the attendant or "turkey herder" must live with the turkeys during the ranging period (Kangaroo Island, near the South Australian coast, with complete freedom from foxes, has become popular as a turkey raising area)

FLYING BIRDS A MENACE TO TURKEYS

Eagles and hawks can cause considerable loss among growing turkeys on range, also from uncovered sun porches of brooder houses The usual methods are to set traps around a decoy—this usually gives a reasonable measure of control Shooting may also be necessary

Fig 179 Large flock of Bronzewing turkeys on open range with ample shade Suitable open range reduces the feeding cost with raising turkeys

NUMBER OF TURKEYS ON RANGE UNIT

The number of growing turkeys in one unit is determined by the efficiency of the watering, feeding, and range facilities In general when allowance is made for emergency situations it is suggested that 2000 birds should be regarded as a maximum for one operator on range with efficient and ample equipment They can be driven on range by means of a well-trained dog for moving when changing over to fresh range areas

ROOSTING TURKEYS EASILY FRIGHTENED

Turkeys may panic on bright moonlight nights or with storms This can result in wide scattering, also smothering and bruising with broken limbs Care should be taken not to flash torches at night and to maintain lighting and other conditions as uniform as possible Foxes can also cause this type of trouble Dim lights, such as lanterns, help as a safeguard

SUITABLE PASTURES FOR RANGE REARING

Feed costs cut 15 to 20 per cent with good range

The area for raising young turkeys must be used exclusively for this purpose, and is best used on a rotational system of use every three or four years with cropping in between

Permanent pastures such as lucerne and clovers are ideal for growing turkeys Lucerne is usually available at the time wanted—during the range period of August, September to December or longer Many clovers will also give excellent pastures during these periods Some planted crops in addition such as wheat, oats, barley, milo, peas, or rape and allowing turkeys to range when crops are ready, will provide valuable feed The labour of harvesting is also saved—the turkeys will harvest it themselves This works out very well—they need only have a hopper of growing mixture all mash in addition They also supply valuable manure for the pastures, and will clean up saffron thistle, blackberries, and grasshoppers on the range

The range should also contain ample shelter—turkeys must have ample shade, and sufficient water must be available in the shade Lack of adequate water close at hand in hot weather is a predisposing cause of pendulous crop with turkeys (Provide 10 to 16 gallons water daily per 100 birds for rearing stage)

RETURNS FROM TURKEYS AND RANGE USED

On the lines of the examples given later in relation to costs, and number of turkeys suggested previously to be carried on a given area, the person concerned can make comparisons as to the likely returns from turkeys on range as compared with cropping the area, or other forms of livestock

HANDLING TURKEYS INTENSIVELY

Raising of turkeys in complete confinement, without their ever being on the ground, is practicable This enables turkeys to be raised in some

areas where it would not be possible otherwise—such as in wet districts with heavy soil These localities are more likely to give trouble with coccidiosis and blackhead than drier, well-drained areas Then again the question of a limited area of land may make range rearing impossible It is also possible to handle turkeys successfully in deep-litter floor system with reduced labour needs

With intensive or confinement rearing the initial stages up to eight weeks would not need to differ in any respect from that discussed for poults that afterwards were transferred to range Conditions alter only after this stage

COMPARISON BETWEEN INTENSIVE AND RANGE REARING

There is less likelihood of losses from foxes, eagles, thieves, parasites and blackhead with intensive methods Good protection from weather can be easily arranged, and a small area of land only is necessary, which reduces the labour of handling A better quality of flesh is claimed for intensively reared turkeys, as being more tender than range-reared birds

Some disadvantages of intensive raising methods as compared with range rearing are higher investment cost for equipment and an increased consumption of feed More trouble is experienced from breast blisters, feather-picking, and foot deformities The diet must be very good and complete in all respects Turkeys of small or medium size are best suited to intensive conditions Sufficient floor space should be provided

The decision as to which system would be adopted is based on the capital and land available, also district conditions Distance from market, labour available, cost of feed, and close proximity of poultry are guiding factors Local problems will be the big guide in weighing the advantages and disadvantages of each system

EQUIPMENT FOR INTENSIVE REARING OF TURKEYS

A requirement for one type of intensive rearing is a shelter with a sun porch, the whole structure being supported well above ground-level The usual height for floor-level is 3 to 4 feet above the ground to allow easy cleaning of droppings from underneath the floor (Some plants on large farms in the United States have floor-level up to 8 feet above the ground to allow cleaning underneath by mechanical means) The portion under cover where the turkeys normally roost (although some roost the birds later in the outer portion when half-grown) usually comprises about one-third of the total floor area of the structure The covered portion can be solid floored with deep litter being used—many operators use wire-netting or slats inside (Slats $\frac{3}{8}$ inch wide by $1\frac{1}{2}$ inches deep and set $\frac{3}{4}$ inch apart have been successful) The outer sun porch area is floored with heavy-gauge wire or wooden slats

General opinion indicates that wooden slats are preferred, as wire-netting sags and affects the feet of the birds to a greater extent Feeders and waterers can be used inside the sun porch, or be attached outside the sides so that turkeys put their heads through to eat and drink

If sloping land is available it can reduce labour, and also the work and cost of construction The structure is anchored to the ground by the enclosed portion being at ground-level (with a slight grading possibly necessary). This portion is then worked with deep litter on a solid floor. The sun-porch area is built out level from this and the slope provides the clearance underneath this slatted portion. This slope also provides good drainage, which means less trouble, with the smell and drying of the manure under the outer portion Feeding and watering can be carried out from ground-level by entering the enclosed portion—saving the use of steps as when the structure is on level ground. This saves considerable labour as 100 turkeys to market stage eat approximately four tons of feed

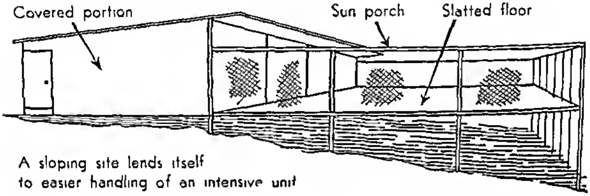


Fig 180 A sloping site lends itself to easier handling of an intensive unit

CONFINEMENT REARING STRUCTURE WITH OUTER SUN PORCH

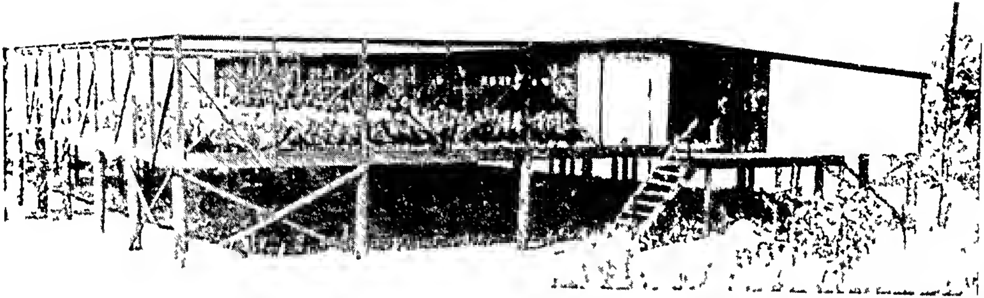
The size of a unit suitable for 100 poults is given. Adjustment can be made by increasing in proportion for larger numbers.

Floor area A floor area of 720 square feet would be advisable for raising 100 poults from eight weeks to marketing. If medium-sized birds, 500 square feet could suffice, but it is suggested that less than 600 square feet should not be used for the number, unless smaller type birds. The smaller the area (as with poultry) the greater the chances of vices developing, and growth will be retarded Two hundred and forty square feet would be under cover and 480 square feet covered with netting only. This could be 12 feet by 20 feet covered and 24 feet by 20 feet as sun porch. Variations can be made to suit materials The area of floor space is the main requirement.

Materials Roof, back, and sides of covered portion (front open to sun porch)—any weatherproof material such as galvanized iron, asbestos, or roofing felt. In mild districts, or with trees close by, the sides can be opened up when birds are older. Overhang roof approximately 3 feet.

Flat roof of sun porch. Large-mesh wire-netting, heavy gauge, possibly 3-inch.

Sides and front of sun porch. Large-mesh wire-netting heavy gauge, 2- or 3-inch.



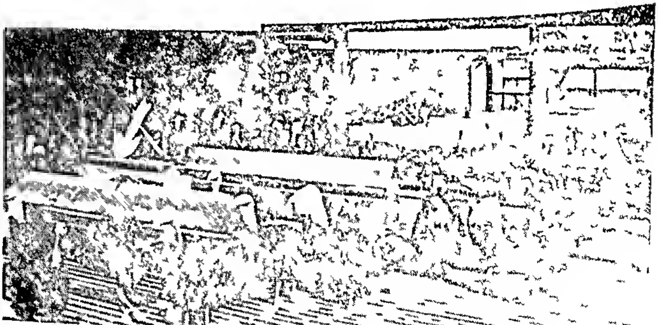


Fig. 181 Above Outside view of large intensive unit showing structure well raised to allow of easy cleaning underneath and one third of the area under cover. *Right* Interior with slatted floor and plentiful supply of feed hoppers to avoid overcrowding which encourages feather picking. Arrow indicates the automatic water supply serving two pens. Capital costs and feed costs for intensive units are higher than for open range system.

Floor Wooden slats of 1-inch by 1-inch or $1\frac{1}{4}$-inch by $1\frac{1}{4}$-inch timber spaced 1 inch to $1\frac{1}{4}$ inches apart Some use narrow slats $\frac{3}{8}$ inch wide set $\frac{3}{4}$ inch apart These are $1\frac{1}{2}$ inches high to give strength, but less surface to catch droppings Supported on a framework of 6-inch by 2 inch for outside and 6 inch by 1-inch for inside framework, spaced 2 feet apart This is carried on posts of hardwood at least 6 inches by 4 inches Wooden floors are preferred They are more durable, stronger, do not sag, and give less foot trouble (Where wire mesh is used it should be 11 to 12 gauge 1-inch by 2 inch If the covered portion was wire-floored, it would be best to have a smaller-mesh netting (1-inch by 1-inch) to spread over the other for a few weeks when poults were first put in)

Height of sides For convenience of attending the birds a minimum of 6 feet in height is suggested for the sides of the sun porch Height of the enclosed portion can be 6 feet at back and 7 feet in front, thus forming a shed 20 feet long by 12 feet wide by 6 feet back and 7 feet in front

General details

Ventilation A ventilation gap about 8 to 12 inches wide should be allowed at back under the roof, to be used as required

Feeders Feeders can be placed inside or outside the sun porch To be weatherproof and provide at least 20 feet of feeding space for 100 poults If feeders are placed under the covered portion they need not be weatherproof If using large drum-type feeders provide one for every 50 poults

Waterers One automatic waterer should be sufficient for 100 poults if it provides about 4 to 6 feet of space Keep in a clean condition, and well shaded

Roosts The space necessary is from 12 to 15 inches per poult raised, according to whether small to large strains are used This means 100 to 120 feet of roosting space—roosts to be 20 inches apart The roosts can be set 6 inches above the floor (to the top of the roost) The low height is necessary to prevent damage to turkeys The droppings fall through the slatted floor (roosts can be higher with solid floor and litter)

Note The roosts can be placed under the shelter, or if deep litter and a solid inner floor were used, they could be placed farther forward near the front of the covered portion under the shed overhang Some operators place the roosts in the sun porch with overhead cover only when the poults have reached the stage of having "shot the red"

Feather-picking This is a hazard with intensive rearing—refer to the section of this chapter on Feather-picking

Deep litter Where deep litter is used the control methods are as set out in Chapter 13 for poultry

A brooding variation Some operators have carried out the entire rearing process in these structures instead of transferring from the brooder house at eight weeks In this case the ordinary brooding method is used as set out. The front of the sheltered portion would need to be closed in, and the floor be covered with a solid material if of slats or netting only. If litter is

normally used no alteration to the floor would be needed This would then be handled as for the brooder unit until eight weeks Infra-red lamps or hover brooders have been used for this purpose

DEEP-LITTER REARING OF TURKEYS

A further adaptation of the intensive-rearing system has been successfully used in the United States This consists of the whole area, instead of the under-cover portion only as in the unit described previously, consisting of deep litter A pole barn-type shed built on ground level 100 feet long by 40 feet wide, 15 feet high at centre and 5 feet at sides has been used* to accommodate 800 turkeys of medium-sized breed The sides are open and covered with netting—protection would be needed on the weather side with heavy winter conditions The roof is weatherproof and overhangs at edges The litter used can be of various materials (corn cobs—although rough in appearance—have been successfully used) Watering and feeding as for the previous unit described, namely one large round feeder for each 50 (comparable size 44-gallon drum) and one large waterer for each 100 suitably arranged to prevent damp spots Debeaking of birds is necessary with this type of operation

With rations correctly balanced in all respects adequate growth can be obtained with this system, and birds be marketed at a reasonable stage with a low labour requirement

FEEDING FOR TURKEYS

Feeding requirements of turkeys differ from those of poultry The rapid rate at which turkey poults grow demands a ration to suit this growth This means a higher level of protein in the feed than for chickens A lack of knowledge of this requirement has caused the loss of a high percentage of poults in the past, insufficient growth, or leg weakness troubles in those that survived This gave rise to the idea that turkey poults were very delicate, but correctly balanced rations have made possible high rearing percentages with turkeys This is shown by the very large flocks now raised by specialist operators in various countries

FEEDING POULTS TO SIX OR EIGHT WEEKS OF AGE

The same feeding can be used at this stage for poults to be range reared or intensively reared The extra consumption of range grasses by the birds outside will adjust the level by less of the high-protein ration consumed

The growth rate of turkey poults is rapid and this can only be maintained by high-protein rations this being particularly necessary with intensively reared birds A ration containing a level of approximately 24 per cent protein should be used to six or eight weeks of age The requirements are high not only for protein but also for riboflavin, vitamins A and D_3, and minerals The higher level of protein meals, and the high cost of these as compared with mill offals and crushed grains, mean that turkey rations

* For reference re construction—this type of shed is very similar to 60-foot by 40-foot shed described in Chapter 12 for 1000 layers This area could accommodate 450 to 500 turkeys, (See also large pen shed Appendix 2,)

are dearer than hen rations Proprietary mixed feeds are available for all stages (starter, grower, and breeder mashes or pellets) which are quite satisfactory, but a check should be made for the stated protein level, and the items listed above A dry mash must have a high percentage of coarse ingredients such as crushed grains, and pellets are quite suitable Fine dry mashes will not give as good a weight gain for a given quantity of feed because of lower energy levels, and can cause a high percentage of the troubles experienced with curled tongue paralysis Suitable high energy rations are given with feedstuffs normally available under Australian conditions to keep food consumption to minimum level

FOREWORD TO TURKEY RATIONS

The rations shown for all stages have adequate levels of energy, protein, calcium, phosphorus, manganese, riboflavin, pantothenic acid, niacin, choline lysine, etc The energy and protein levels for each stage are adequate, being *approximately* 810 energy 24 per cent protein (33/1 ratio) for day-old to 8 weeks, 760 energy 20 per cent protein (38/1) for 8 weeks to 16 weeks, 850 energy 16 per cent protein (53/1) for 16 weeks to 24 weeks, and for breeders

BASE FORMULA

High Energy All mash Turkey Ration—Day-old to 8 weeks 100 lb
(24 per cent protein)

Ingredients

32 lb crushed wheat	($1\frac{1}{2}$—4 gl bucket)
16 lb crushed oats	(1—4 gl bucket)
12 lb crushed barley	($\frac{3}{5}$—4 gl bucket)
20 lb (50 per cent protein) meatmeal	($\frac{4}{5}$—4 gl bucket)
6 lb liver meal	($\frac{1}{5}$—4 gl bucket)
9 lb milk powder	($\frac{1}{2}$—4 gl bucket)
5 lb lucerne meal	($\frac{1}{3}$—4-gl bucket)

$\frac{1}{4}$ to $\frac{1}{2}$ lb salt and $\frac{1}{4}$ to $\frac{1}{2}$ oz manganese sulphate

2 oz A and D_3 powder containing 10,000 units of vitamin A, and 2000 units of vitamin D_3 per gramme (extra vitamin B_2 to add 1 p p m in feed also helpful)

Note When bran and pollard are approximately $\frac{3}{5}$ price of crushed wheat (and other grains comparable value) per lb then use to replace 20 lb of the grains in all the rations listed for turkeys Also vitamin E in synthetic form can be added (Other vitamins, amino acids, and mineral supplements, as shown economic, can be added to *all* these base rations)

1 Antibiotic supplement is normally added at the rate advised by the manufacturer for the product used Antibiotics increase the weight of the bird for a given quantity of feed in the growing stage with turkey poults (as with cockerels) under average rearing conditions

2 Small hard grit can be sprinkled over the feed occasionally (or include approximately one per cent)—no shell grit required with this mash

3 Calcium and phosphorus levels are important, hence when the ration

is altered adjust—e g adding 4 lb bonemeal if 16 lb of 60 per cent protein meatmeal replaced 20lb of 50 per cent protein meatmeal

4 If no milk powder available increase meatmeal 6 lb grain 3 lb and add synthetic riboflavin to give extra 3 parts per million in the feed

Comments

Feeding good quality chaffed fresh greenfeed (cut fine—$\frac{1}{4}$-inch lengths) is recommended—this can be sprinkled over the mash and encourages feeding It can also save 10 to 15 per cent of feed cost Feed once or twice daily Alternatively, use lucerne meal Skim milk when available is used by some operators If it can be made available (in clean receptacles which the poults cannot get into) it will allow elimination of the milk powder and nearly 50 per cent of the meatmeal This is based on the skim milk being available at all times Some water should also be allowed (One water vessel to three of skim milk is suggested) Care must be taken with this—in general it is not advised in view of labour and it is better to feed the mash as set out, but in the event of protein shortage this can be used The skim milk can be handled more easily during the growing stage

Teaching Poults to Feed Important

Providing ample feed in feeders at all times, the use of extra small raised feeders inside the battery brooder or around a floor brooder, finely chaffed greenfeed sprinkled on the mash, are all measures to promote feeding Poults give more trouble than chickens The sooner they are fed after hatching the better Force feeding has some times been adopted for stubborn cases (some mash mixed with water or milk is used but care and skill is required) Feed turkeys in troughs or with hoppers at all stages—not on the ground

Type of Feed for Young Poults

A coarse dry mash will give results comparable with crumbles or pellets There is probably less waste with crumbles or pellets and an even distribution of ingredients is possible Wet mash can be used for floor or outside rearing, but considerably increases the labour This could be used if bran and pollard only were available without crushed grains Extra grain feed in addition to the mash is not necessary for this stage Feed should be fresh—mouldy feed must not be used at any stage

Water Important

Ample clean water must be easily available to turkey poults at all times Even a short period without water can do considerable harm to the poults Drinking must be watched—brightly coloured marbles in the water assists in teaching poults to drink (See pp 538 and 542 for quantities)

Care for Feed—and It should Be Fresh

Do not store feed for long Feed loses value when stored for a considerable period—particularly with heat and light Avoid losses due to rats and mice by using bins—or bags should be used in rotation, that is the oldest bags first Do not overfill feed hoppers or troughs or poults can easily "hook it out" and waste it on the floor

GROWING STAGE FOR TURKEY POULTS

The feed is changed (*and* reduced in cost) from eight weeks to marketing A growing mash containing 20 per cent protein is used with very little additional grain for this period, and then introduce 25 to 50 per cent grain at the sixteen week period and make slight adjustments in the mash If birds are on range at this stage with standing crops available no grain need be fed They could harvest their requirements

Suitable Grains

A mixture of grains is advisable If growing stage poults are on range with a crop available they can harvest their own requirements Maize and wheat have the highest value as a grain, but turkeys find oats very palatable Oats are also a valuable safeguard against feather picking, particularly with intensive rearing For general use a mixture of equal parts wheat (or maize) with barley and oats is sound Sorghum can replace any of these grains for older growing stock or adult breeders—but not the early stage to possibly ten or twelve weeks If rearing intensively the proportion of oats can be increased or one hopper of oats made available and other hoppers of mixed grains

High Energy All mash Turkey Ration—8 weeks to 16 weeks stage 100 lb (20 per cent protein)

Ingredients

35 lb crushed wheat	($1\frac{3}{8}$—4 gl bucket)
16 lb crushed oats	(1—4 gl bucket)
12 lb crushed barley	($\frac{3}{5}$—4 gl bucket)
14 lb (50 per cent protein) meatmeal	(^{1}—4 gl bucket)
6 lb liver meal	($\frac{1}{5}$—4 gl bucket)
3 lb bone meal	(*1/12 approx* —4 gl bucket)
3 lb milk powder	($\frac{1}{5}$—4 gl bucket)
12 lb lucerne meal	($\frac{4}{5}$—4 gl bucket)

$\frac{1}{4}$ to $\frac{1}{2}$ lb salt and $\frac{1}{4}$ to $\frac{1}{2}$ oz manganese sulphate

2 oz A and D_3 powder containing 10,000 units of vitamin A, and 2000 units of vitamin D_3 per gramme (Vitamin B_2 as for day old to 8 weeks)

Note Greenfeed and up to 10 per cent whole grain can be fed with this mixture, and make any adjustments for substitute ingredients as set out under Base Formula ration Day old to 8 weeks

For 16 weeks to 24 weeks stage—Feed Mash and Grain

Use the 8 to 16 weeks stage mixture (*with A and D_3 powder increased to 3 oz* as only alteration) for mash

Feed with 50 per cent of grain, and soft grit (shell grit or limestone grit) can be made available as free choice

Note There are three *alternatives* which can be used *for the grain portion* at this stage

(*a*) provide a hopper of whole grains with the turkeys having free choice; or

(*b*) turkeys to have access to a standing crop of grain if on range, or

(*c*) add 50 lb crushed grain to the mixture and give as all mash

1 Feed greenfeed in addition if used for intensive rearing or not available on the range

2. Allow access to hard (or insoluble) grit only to sixteen weeks not shell-grit also Limited access to shell-grit can be allowed after that or add 2 to 3 per cent to the mash With unlimited supply a craving may develop

3 Antibiotic supplement can be continued

4. Skim milk feed to growing poults Some operators use skim milk This saves the need for milk powders, and meatmeal can be reduced The labour involved is considerable, but can mean reduced costs A tendency to pendulous crops may occur with this practice—give ample shade.

FEEDING TURKEY BREEDERS

A suitable ration for turkey breeders should contain about 20 per cent protein and be fed with 50 per cent of grain mixture, giving an overall level of 16 per cent protein This is above the protein as for laying hens, and the requirements are much higher for riboflavin, vitamin A and D_3 and minerals (as with breeding hens) This provision in the breeder diet means healthy chickens or poults that have been given a good start in life.

To make for easier feed preparation use the 16-24 week mash

High Energy Ration for Turkey Breeders

Use the mixture shown for 16-24 weeks (with A and D_3 level increased as shown) and feed with 50 per cent whole grain (This means that the same basic feed is used for breeders and poults from 16 to 24 weeks stage, but do not use antibiotic for breeders)

Adjust as discussed for growing ration for substitutes for ingredients

Comments

1 Ample greenfeed should also be fed to breeders to maintain a high vitamin A and vitamin E level. If this is not available add vitamin E to feed for breeders at manufacturer's suggested level

2. Allow free choice of limestone grit or shell-grit or if added to mash 10 per cent must be included to cover calcium level for mash and grain Also allow free choice of hard insoluble grit Water needed is 15 to 17 gallons per 100 daily.

3 Wet mash can be fed, if bran and pollard included at high level with economic price (give double dry all mash feed space) This requires more labour, but can produce high quality turkeys

4. The above ration can be altered to all mash (particularly suited for use with intensively housed birds) by adding 50 lb. of crushed grain.

Special ration used for first Random Sample Test (Turkeys) Hawkesbury Agricultural College, N.S.W. This ration was formulated by M. W. McDonald, formerly Poultry Research Station, Seven Hills.

Ingredients	*Poult Starter 0-8 weeks*	*Grower 8-16 weeks*	*Finisher 16-28 weeks*
Wheat meal	49 lb.	62 lb.	66 lb.
Bran	5 lb.	—	—
Pollard	3 lb.	—	—
Crushed Oats	—	10 lb.	10 lb.
Meatmeal	14 lb.	11 lb.	11 lb.
Peanut meal	14 lb.	4 lb.	—
Liver meal	6 lb.	4 lb.	3 lb.
Lucerne meal	3 lb.	4 lb.	5 lb.
Skim Milk Powder ..	3 lb.	2 lb.	2 lb.
Limestone Powder	2 lb.	1 lb.	1 lb.
Bonemeal	—	1 lb.	1 lb.
Vitamin Concentrate ..	1 lb.	1 lb.	1 lb.
Protein percentage	25	18.3	16.7

AMPLE FEEDER SPACE FOR TURKEY POULTS

Allow 12 feet of feeder space for 100 poults to eight weeks of age (and allow 4 to 6 feet of waterer space for 100 poults to same stage). Allow 20 feet of feeder space for 100 poults eight weeks to marketing stage.

TABLE 23

AGES, WEIGHTS, AND FEED QUANTITIES FOR TURKEYS

Good Range-rearing Conditions

Age	*Approx. average weights*			*Approx. total feed used*	*Approx. feed used per lb. live weight*
	Males	*Females*	*Average*		
	lb.	lb.	lb.	lb.	lb.
1 month	1.3	1.2	1.3	1.6	1.2
2 months	4.0	3.6	3.8	8.5	2.2
3 months	8.3	6.7	7.5	18.5	2.4
4 months	13.0	9.8	11.4	34.0	3.0
5 months	17.8	12.2	15.0	48.0	3.2
6 months	22.0	14.0	18.0	65.0	3.6
7 months	26.0	15.0	20.2	87.0	4.3

Efficient Intensive-rearing Conditions

Age	*Approx average weights*			*Approx total feed used*	*Approx feed used per lb live weight*
	Males	*Females*	*Average*		
	lb	lb	lb	lb	lb
1 month	1 3	1 2	1 3	1 6	1 2
2 months	4 0	3 6	3 8	8 5	2 2
3 months	8 1	6 3	7 2	20 0	2 6
4 months	12 5	9 3	10 9	39 0	3 6
5 months	17 0	11 4	14 2	56 0	3 9
6 months	20 2	13 4	16 8	74 0	4 4
7 months	23 9	14 3	19 1	98 0	5 1

Note These figures can be improved on by top line operators, but give an average basis for good operation

Allow 40 feet per 100 for adult breeders on range or intensively This applies for dry all mash, and figures given are minimum needs Water can be supplied by one large automatic waterer for each 100 poults

AVERAGE GROWTH RATE OF TURKEY POULTS

The rate at which turkeys can be grown will decide the margin of profit to be made Table 21 gives a guide to the approximate average weights of Bronzewing turkeys that can be obtained with good husbandry for a given quantity of high energy level feed

Note Early-hatched turkeys with cool conditions will show better weight gains than those hatched later in the season and experiencing hot weather during the growing period

Table 21 gives information covering the best periods for growth under range and intensive conditions Some points that can be highlighted are

1 Range rearing methods have shown a saving of up to 18 per cent on feed at six months of age in this example by producing birds with 3 6 lb of feed per pound as compared with 4 4 lb intensively (Feed costs are approximately 60 per cent of the total costs in turkey raising) This shows the economy of range rearing where good conditions are available such as good pasture and standing crops (Nine lb of feed saved at, for example, 3c per lb and one extra pound on the turkey at, for example, 35c per lb , means 65c extra on a turkey at six months of age) If standing crops were not valued for their grain value the saving in feed costs could be rated very much higher, possibly up to 40 per cent saving on intensive, but all grains grown are worth the price obtainable for them by sale, and if used for the turkeys must be assessed as a cost against them

2 The table shows that marketing at the four- or five month stage can be a profitable proposition with a 4½-month bird weighing about 13 lb at 3 1 lb feed used per pound of live weight This can show a favourable

conversion rate when compared with a bird at six months of age of 18 lb weight, at 3 6 lb feed used per pound live weight, when labour is considered However, the extra gain per bird for another six weeks represents additional gross return, but if 5c per lb higher price became available at this stage more money could be made by selling early This could be a matter for consideration if a very favourable market occurred when birds had not reached normal maturity When selling on a fixed contract basis the later marketing stage would show the greatest gain Assessment of market demand is involved Latest trends indicate greater interest in early stage disposal

3 The figures at seven month stage show that it does not pay well to hold turkeys over six months—too much feed is taken for the weight gained Where 14 lb of feed used from four to five months gave 3 6 lb increase in weight per bird on the range rearing table (4 lb feed to 1 lb meat) 22 lb of feed used from six to seven months of age only gave 2 2 lb increase (10 lb feed to 1 lb meat) The ratio becomes worse after this—seven to eight months could mean 12 lb feed to 1 lb meat With feed at 3c per lb and the price at 30c per lb live weight as an example, this would show a slight loss at six to seven months and a marked loss at seven to eight months, and no return for labour by holding for the extra time This shows that it is vital to returns to market on time The longer birds are held the less the gain per pound of feed used—as a ready-reckoner basis market by the time they have reached 4 to 5 lb of feed used per pound of weight produced if possible The energy/protein ratio of the feed must be watched in relation to costs as with laying hens and raising grillers

Feeding A reference is suggested for a very simple method of feeding turkeys It could be of particular value for sideline operations, and in developing areas where ingredients may present problems This is by use of the all purpose concentrate mixture which is given in detail in Appendix 1 Adjustment for the three stages—day old to 8 weeks, 8 weeks to 16 weeks, 16 weeks to market—is made by varying the proportions of grains to the one base concentrate

COSTS AND RETURNS WITH TURKEY-RAISING

Some examples are given with feed prices and returns as examples Calculation can easily be made for local variations in feed costs and prices received for turkeys

ESTIMATE OF FEED COSTS

An estimated basis can be used of $1 50 per bushel of 60 lb for wheat, and other grains in proportion, and $90 average price for protein meals (meatmeal and milk powder) This basis would give an average price of 2c per lb or approximately $60 per ton, over all stages When purchasing prepared feeds with a margin for labour the cost will be higher—calculation can easily be made for the increased rate on per pound or per ton basis (As a ready reckoner basis 30 turkeys can be raised to market stage for 1 ton of feed on range or 25 under intensive conditions)

General Costs Basis per Turkey Raised

Costs

1	Day-old cost of poults	80c	
2	Brooding charges 10c and	35c	
3	Mortality allowance 25c		
	Interest and depreciation on plant and working expenses*	10c	
4	Approx 70 lb feed @ 3c per lb to 6 months of age		$2
			$3 25

Cost per lb live weight (without labour)
= 19c for 17 lb average
= 18c for 18 lb average
(with feed 1c per lb more would be 22c and 21c respectively)

Explanation on Costs

1 Possible purchase price—less if produced on unit as labour margin saved The increase or decrease in this item can be determined on the basis of local costs

2 10c allowed as only half number in brooder as compared with chickens 5c was allowed as a basis for chicken brooding costs

3 A suggested 20% loss to 2 months would mean day old cost (80c) plus possibly 6 or 7 lb of feed at 3c per lb (approx 20c) total $1 00 for each poult lost If 20% or 1 in 5 lost the remaining 4 have to carry the debt of $1 00 or 25c each With lower mortality this would be reduced in proportion

4 Basis of 70 lb has been taken as an approximate average This could be 5 lb less for range reared (approx 15c saved) or 5 lb more for intensively reared (approx 15c extra) This could mean 30c between range and intensive for feed This could be a greater margin if extra growth obtained†—for example 1 lb extra weight could mean an extra 30c to 35c according to price received

* This item will vary according to type of plant, and volume of turnover

Returns
(3 examples given)

The returns for various stages and average weights for hens and gobblers could be

1 If sold at 6 month stage weighing 17 lb (and costs as shown $3 25)
(*a*) 17 lb @ 25c per lb live weight = $4 25
Margin $1
(*b*) 17 lb @ 30c per lb live weight = $5 10
Margin $1 85
(*c*) 17 lb @ 35c per lb live weight = $5 95
Margin $2 70

Note Check comments 4 under costs for difference in costs for range and intensive, as the difference due to feed cost could be 15c under or 15c over the above cost

With these costs it would appear that 25c to 30c would be necessary to show a labour margin over costs Percentage margin on costs would be
(*a*) 30%, (*b*) 57%, (*c*) 83%

With birds weighing 18 lb

2 An increase of 1 lb live weight per bird to 18 lb at 6 month stage by range rearing or better husbandry or stock would mean (over the same cost of $3 25)
(*a*) 18 lb @ 25c per lb live weight = $4 50
Margin $1 25
(*b*) 18 lb @ 30c per lb liveweight = $5 40
Margin $2 15
(*c*) 18 lb @ 35c per lb live weight = $6 30
Margin $3 05

Note This shows the increased return possible by improving the feed conversion rate from 4 1 lb of feed for 1 lb meat as for *1*, to 3 9 lb of feed for 1 lb meat for *2*

Efficiency on this basis can enable a reasonable profit when lower prices are received Percentage margin on costs in this case would be
(*a*) 38%, (*b*) 66%, (*c*) 93%

Note If only 20c per lb received the margin of 35c over costs would only show approximately 10% on costs

Costs—continued

Costs can be adjusted for lower or higher feed costs per lb.—1c. per lb. rise or fall would mean approximately 60c. on costs.

Note. If sales are made at 4½-month stage the feed could be reduced to 40 lb, which would cost $1.18 for feed—a reduction of 82c. on costs above to $2.42 (all other charges the same).

† (Feed supplements such as antibiotics can be a marked factor in improvement of growth rate in early stages, also the energy level of the ration affects the feed/meat ratio.)

Returns—continued

3. If sales made at 4½ months with 13 lb. weight then the margins over the cost of $2.42 shown opposite could be as follows for the following prices received:

(*a*) 13 lb. @ 25c. per lb. = $3 25
Margin .. .. . 82c.

(*b*) 13 lb. @ 30c. per lb. = $3 90
Margin $1 48

(c) 13 lb. @ 35c. per lb. = $4 55
Margin $2 12

Percentage margin on costs in this case would be:

(*a*) 34%, (*b*) 60%, (*c*) 87%.

This is comparable on percentage with *2* less gross return—but labour saved.

Comment

Margins in all cases show that with costs given as an example efficient rearing is needed. Birds weighing for example an average of 12 lb. at 6 months owing to poor feeding rations or overcrowding would show a loss or a very small profit margin at these prices.

Note: The above examples give a basis upon which to assess returns and costs involved with turkey-raising. Local adjustments can be made for costs, mainly governed by feed prices, and returns on the basis of the price per pound (plus the efficiency of the meat grown for a given quantity of feed). The sale of birds at the earlier stage is primarily bound up with likely price moves for meat.

GENERAL POINTS ON TURKEYS

COMPARISON WITH GRILLER (OR BROILER) RAISING

Some may desire a comparison in the returns between raising turkeys intensively and raising grillers. This comparison is mainly decided by the price to be received per pound for the meat.

If griller raising is being conducted on a reasonably efficient basis then a comparable return is possible on the same price for feed purchased and meat sold. The price for turkey rations is usually higher, hence a premium on the meat is needed, e g. 1c. per lb. on feed needs about 5c. extra per lb. live weight for reasonable margin.

The handling of a much smaller number of stock with turkeys owing to the greater value of each bird will be a point with some. Availability of safe range and ability of turkeys to clear standing crops and make more efficient use of range growth could be a big factor. Preference for turkeys or grillers, also plant costs, particularly for intensive rearing, and market demand available for both meats, can be responsible for decision on this question.

REAR SEXES SEPARATELY—HOW TO IDENTIFY

If it can be arranged it should be made a rule to rear the gobblers apart from the hens, as both sexes will do better as a result Turkeys can be sexed at day-old as with chickens If this is not carried out, separate as soon as the sexes are readily discernible At about the seventh week the fleshy protuberances (which appear at about five weeks) begin to extend down the neck The "snood" on top of the head becomes relatively large, plump, and elastic in males, but in females is small and thin Males usually strut about The beard, a tuft of hair-like feathers, appears on the breast of males about three to four months of age (some females may show this, but smaller and finer) Breast feathers at about 12 weeks for male Bronzewings are bronze-black with no white, whereas the females have narrow white edging on the tips If sexing at day-old has been carried out identification can be made as for chickens by toe punching the web between the toes—a clean cut must be made or it will grow over The electric toe punch will cauterize, as it burns the hole and there is little danger of the hole growing over Wing banding is another method The wing band is clinched around the poult's leg for two or three weeks and can then be inserted into the wing The type of wing band which is suspended from the wing by a wire bent to form a half-circle is satisfactory

PREVENTION OF FLYING

It is necessary to clip the large outer flight or primary feathers of one wing to prevent excessive flying Wing feathers may be clipped with heavy shears, tinsnips or hedge clippers These measures will prevent clearance of ordinary fences about 8 feet in height

It is good practice to clip one wing when birds go out on range if flying is to be prevented Do not clip the wings of breeding gobblers or if necessary both wings lightly only, or it interferes with mating Permanent and almost complete prevention of flying can be carried out (but do not do this with breeding gobblers) by treating turkeys at about one week old The practice is to clip off the entire terminal segment (corresponding to the hand on a human being) of each wing, making the cut just a little way down from the last joint of the wing so as not to damage the joint, but still remove nearly all the segment that bears the pinion and flight feathers Turkeys so treated are described as quieter and also easier to pick when dressed for market If breeding gobblers are to be selected by choosing the best from the flock for mating, then this would not be carried out

HORMONE INJECTION FOR TURKEY GOBBLERS

The question of raising the sexes separately was discussed previously The fighting that occurs among turkey gobblers can be quite a nuisance and all disturbances mean a loss in the average weight of a consignment This can result in those bullied by their fellows being reduced in weight and carcasses spoilt in appearance

The use of chemical caponizing as with cockerels can be of assistance in this respect. The same injector and stilboestrol pellets are used as described in the previous chapter. The injection is carried out high on the neck in the same manner, but the number of pellets necessary must be increased One pellet is used for approximately 3 lb live weight, hence a gobbler at three and a half to four months weighing 11 to 12 lb would require 3 or 4 pellets of 15 milligrammes This should suffice until marketing stage at six months of age

The average weight of gobblers is slightly improved, also flesh texture The main gain is in helping to reduce fighting among the growing gobblers, and in assisting to produce a more attractive dressed turkey Refer Chapter 18 for comments re hormone injection practice

TURKEY MANURE A VALUABLE BY-PRODUCT

Turkey manure is very valuable in nitrogen, phosphate, and potash. A hundred growing turkeys can produce about 2 tons dry weight (or 6 to 7 tons wet) of manure by marketing stage Turkey manure is rated high in nitrogen, and if mixed with 10 per cent superphosphate, the valuable nitrogen is saved, otherwise it loses value quickly Turkey litter is rated with good laying-house deep litter at 3 per cent nitrogen level, in addition to phosphate, potash, trace elements, and organic material Two hundred turkeys ranging on an acre of land every three or four years (average 50-70 per acre each year) would keep the level of pasture fertility at near maximum—the reported experience of one of our largest turkey growers in Tasmania is in line with this Turkeys on range spread the manure quite well—from intensive sun-porch type structures it would have to be collected and spread (covering with 10 per cent superphosphate as suggested above)—when using spread thinly The turkey litter in the covered portion of an intensive structure or in the deep litter type intensive unit can accumulate as with hen litter

The sale value and composition of manure could be assessed as for deep litter as covered in Chapter 13 This can be a valuable sideline, as nearly half a hundredweight of manure (dry weight) from one turkey could, if suitably marketed, be a considerable help to returns of the turkey unit

CARE IN MARKETING OF TURKEYS

Check turkeys for weight around twenty to twenty-four weeks—if well-grown birds they should be ready for market They should show fat in the skin and not have pin feathers too short Cool weather during the late stages tends to speed up growth and maturity Do not restrict feed—and leave range birds on range until marketed, if penned they fret

Confinement birds are usually slower, but if fed a correctly balanced feed and given plenty of room they mature well Be very careful not to bruise turkeys by handling roughly when catching for market Wings or legs can be easily broken A sound practice is to run them into a narrow runway at the corner of a netted run The top of the runway is covered with netting An opening about 16 inches high can be left on one side (measuring from ground-level) The birds may then be caught by the legs

and taken out This will cause a minimum of disturbance and injury A lack of care in the last stage can reduce returns through birds having abrasions and bruises, and thus being down-graded in price Normal practice in Australia is to send birds to market* or sell direct to farm buyers—dressing on the farm is not usually carried out If one wishes to dress the birds on the farm the 25 per cent loss in weight (10 per cent loss for bleeding and plucking and 15 per cent in drawing) must be allowed for in calculating the price—for example 30c live weight means 33c bled and plucked and 40c dressed without labour allowance

DRESSING TURKEYS

Very little information is given on this for the reason mentioned above Before killing, birds are usually starved for twelve to eighteen hours, but water is available. If to be killed in the evening they can have some mash in the morning Killing is usually by the sticking method, using a narrow blade knife about 4 inches long and penetrating the rear lobe of the brain through the roof of the mouth This calls for practice and a knowledge of the technique Farm dressed birds can be dry-plucked, but the semi-scald method is usually employed Birds are immersed and agitated for nearly half a minute in water 126°F to 128°F, although some use 140°F for short period and results are good They are then picked clean, either with machine and finished by hand, or completely by hand

TURKEY DISEASES AND THEIR CONTROL

The best preventive of turkey diseases is correct feeding on rations as set out, good sanitation by avoidance of insanitary areas around waterers and feeders, and avoiding overcrowding on the range or under intensive-rearing conditions Turkeys have a high value per bird and advice should be sought without delay from qualified veterinary sources—either private practitioners, or the Department of Agriculture in your State Some rule-of-thumb directions are given here mainly on the basis of outlining preventive measures For complete information on Turkey Diseases listed refer to T G Hungerford's *Diseases of Poultry*, Australian Agricultural and Livestock Series

BLACKHEAD (Enterohepatitis)

Blackhead has been a bane to the turkey industry Heavy mortality can occur—the symptoms are that the bird is drowsy, wings droop with ruffled feathers and there is yellow-coloured diarrhoea Death occurs in two or three days The head may be darkened The liver shows yellowish and circular necrotic areas Mortality may be up to 100 per cent Drugs have been developed that will now control blackhead, these being used for treatment and for prevention

* When marketing give ample space in crates See p 523 for crate sizes Large specialized processing plants are established and are the usual purchasers If local sales can be made on dressed bird basis then small type dressing units can be purchased, See design for dressing room Appendix 6,

T. G. Hungerford mentions Enheptin T (Entramin) as one of the most effective drugs. The advent of these drugs has been a great step forward, but the empbasis from a husbandry viewpoint must be on dry conditions around waterers and feeders and clean fresh range. Also feed on rations that will build resistance by steady growth rates among birds not overcrowded. Do not run fowls on the same range as turkeys at any time, as they can act as carriers. A high level of husbandry is the rule as a safeguard. If the trouble occurs get in touch with qualified sources quickly. It is sound practice to check up on this trouble, and have the treatment ready as a precaution in case it happens.

SINUSITIS (and Vitamin A Deficiency)

This is listed by T. G. Hungerford as probably the most important disease affecting turkeys other than blackhead. The characteristic symptoms are swellings around the eye, which assume large dimensions. The symptoms of vitamin A deficiency are similar, but sinusitis is listed as an infectious complaint. A deficiency of greenfeed or vitamin A substitute and poor sanitation are predisposing causes (although outbreaks of sinusitis have occurred where greenfeed was abundant on the range). Treatment is carried out by veterinarians by removing the fluid from the swollen sinuses and injection with silver nitrate solution. (Reports indicate streptomycin is used widely for this purpose in U.S.A.) Early contact should be made. Vitamin A deficiency causing swollen sinuses can be prevented by feeding ample greenfeed, or sufficient oil emulsion or powders containing vitamin A at correct levels plus lucerne meal.

FOWL-POX

Turkeys are subject to fowl-pox as are poultry. The typical scabs are present. Vaccination can be carried out at twelve to fourteen weeks of age. Qualified operators should carry out the vaccination, or instruction be obtained.

VITAMIN DEFICIENCIES

The various vitamin deficiencies covering vitamins A, B_2, D_3, E, K, and also acid deficiencies that can occur with symptoms of poor growth or heavy mortality should be avoided if the rations listed are fed without omissions and combined with ample greenfeed.

PEROSIS (Slipped Tendon)

A deficiency of manganese plays a large part. An excessive amount of minerals can also cause the trouble. This can be prevented by feeding correctly balanced rations as set out, with adequate levels of manganese, riboflavin, and by using good-quality 50 per cent protein meatmeal as set out in the rations—poor-grade meatmeals of low protein and excessive mineral content can cause trouble.

CROOKED BREAST IN TURKEYS

Feed correct rations with adequate manganese, riboflavin, vitamin A and D_3, and a sufficient level of calcium and phosphorus. The rations set

out will comply in this respect Also do not breed from crooked-breasted turkeys Use wide flat perches These measures will cover both hereditary and nutritional factors for this complaint

PENDULOUS CROP

Inherited factors may predispose to this condition, but local conditions, such as high temperatures and lack of sufficient waterers under shade, will cause this tendency to develop Keep a close watch on all stock, so that birds showing any tendency, among either males or females, are not bred from A suitable range should have ample shade, and a number of watering points close to the birds Affected birds may develop a crop as big as a football Some endeavour to empty the crop by turning the bird upside down and manipulating and emptying the crop Another method is to tie up a portion of the crop so firmly that it sloughs off This increases the tension on the rest of the crop The crop will need emptying for some days when this is done

PULLORUM DISEASE

The disease does not affect turkeys to a marked degree Treatment of poults, as with chickens, can be carried out with sulpha drugs to reduce losses, but blood testing is the only method of eliminating this trouble Purchase stock only from clean blood tested sources

LICE AND MITES

These can be a cause of trouble with turkeys as with poultry Dusting of breeding gobblers with an insecticide or sodium fluoride is advised Red mites (and ticks) should be looked for and dealt with as described for poultry If saddles are used on hens check underneath for lice

DEFORMED BEAKS AND CURLED TONGUE CONDITION

Feeds ground too finely—lacking sufficient coarse ingredients—are cited as a cause of these troubles Losses can be heavy The correct types of feed as set out should be used

BOTULISM (Limber Neck)

This condition is caused by turkeys having access to decomposing food, old bones, or vegetable matter, symptoms being paralysis of neck, wings, and legs—neck in unusual positions The disease is fatal

FEATHER PICKING AND CANNIBALISM

Feather picking can be a problem with growing poults It may assume serious proportions when turkeys are raised in confinement It can be stopped by debeaking back a quarter of an inch of the upper beak, that is about half way between tip of beak and nostril The electric debeaking machine is the best for this purpose Sometimes the lip of the lower beak is also cut off, but usually only the upper beak Management practices, which will help prevent the trouble, are

1. Have a lightly stretched wire (11 or 12 gauge) stretched above the feeder for beak cleaning.

2. Allow sufficient space (5 to 7 square feet per bird in confinement).

3. Allow 20 to 40 feet feeder space per 100 turkeys.

4. A correctly balanced ration containing coarse ingredients or pelleted feeds.

5. Feed whole oats as 50 per cent of the grain fed or give access to a separate hopper.

6. A bale of hay for birds to pick at helps to provide occupation.

7. Some wet mash in addition to the dry feed helps when this trouble occurs.

Birds picked can be painted with stockholm tar.

Note: The provision of ample room, clean fresh surroundings, and the correct rations outlined will go a long way to preventing troubles outlined. For full information on turkey diseases, as mentioned previously, refer to T. G. Hungerford's *Diseases of Poultry*—Australian Agricultural and Livestock Series.

ACKNOWLEDGMENTS

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G. W. Smith, Livestock Officer, Poultry; G. L. McClymont, formerly of Glenfield Research Laboratory; D. G. Christie, Veterinary Officer; and I G Pearson, Veterinary Research Officer, "Turkey Raising"—a New South Wales Department of Agriculture Publication.

W. C. Mills, Jnr., "Breeding and Growing Turkeys—North Carolina"—Extension Circular No. 315.

S Froome, "Raising Turkeys"—Journal of Agriculture of Western Australia.

Reference A very valuable reference suggested for Australian readers is the Report of the Eleventh Annual Turkey Raisers' School and Convention, held at Wagga, May 1962.

3 Correct practices of breeding and rearing need to be carried out, with a careful check of the variations described in handling turkeys as compared with chickens Purchase of day old stock from specialized sources is usual practice with birds being raised for market

4 Range rearing gives the most economical use of feed and capital for a given weight of meat Intensive rearing is suited to certain localities and will give efficient results with low labour requirements The area and type of land available will enable decision as to the system to be used Adequate equipment to give sufficient space for feed and water space is needed, also sufficient area as listed for intensive or range rearing

5 The rotational use of range is very necessary with turkeys, coupled with sanitary conditions around feeders and waterers

6 Use of correctly balanced rations as set out in this Chapter (and in Appendix 1) is recommended and providing greenfeed also is good practice

7 Use of good husbandry methods on the lines recommended is the safeguard against disease problems with turkeys, and the principal means of achieving desired market weights When disease complaints occur seek qualified advice without delay

8 The examples of costs and returns given will serve as a guide to the economic returns possible with turkeys and the number needed for sufficient returns Adjustment can be made for varying prices for feed and for meat to determine the profit margin possible with efficient methods

CHAPTER 20

DUCKS

THE raising of ducks in Australia has been mainly concentrated on table ducks, in spite of the fact that certain breeds are capable of very high production figures This has been shown both in Australia and overseas

The prejudice that exists on the Australian market in relation to duck eggs, and also the difficulties associated with export of duck eggs, has been a deterrent to any marked expansion of duck egg production

The main emphasis today is on ducks for table purposes, and in this chapter some suggestions are given covering the general requirements of duck raising There are over twenty different breeds of ducks and many breeds include a number of varieties

BREEDS FOR ORNAMENTAL PURPOSES

There are a number of ornamental varieties, which are kept in ponds or lakes by private people or in botanical gardens, public parks, and sanctuaries

Some of these are very beautiful and are generally small in size, although some are capable of quite good growth

Sheldrakes are very beautiful, and lend a great deal of beauty and colour to their surroundings Rouens, although a larger breed, are also beautiful, and fit in well with any of these types of surroundings The ducks kept for ornamental purposes, with ample water and natural vegetation, usually require very little care except some grain daily This publication deals with those breeds adaptable to commercial purposes, but the ornamental background to ducks is mentioned, as from these and the wild ducks our domestic breeds originated

BREEDS FOR EGG PRODUCTION

Indian Runners, both white and fawn and white, and Khaki Campbell ducks are the two breeds favoured for egg production Outstanding egg-production figures have been obtained from these breeds In the 1920 s duck egg laying competitions were being regularly conducted in Australia in various States

Scores of up to 335 and 344 eggs for Khaki Campbells in 365 days were reached, also a score of 126 eggs in 122 days in the winter test in 1932 was recorded at Burnley, and 365 eggs in 365 days were laid by a White Runner duck at Geelong in 1926 7

Overseas countries have also obtained outstanding scores—one report from Holland indicates a duck laying 442 eggs in 442 days

In view of these figures, the reader may well ask why ducks are not

extensively farmed in this country for egg production The reasons are that when ducks are placed in large flocks, they do not lay as well as anticipated A shock or a fright is likely to throw them into a partial moult They need to be handled very quietly and carefully by the operator dealing with them A light at night can cause a stampede Also they eat more feed for a given egg production than poultry, and they foul pens or ground much more rapidly than hens

Finally there is a prejudice against their eggs on the local market There are some individual markets that may prefer duck eggs and any person desirous of entering the egg production field is advised to check on this point The general market pays a lower price than for hen eggs, as the field is more for cooking purposes than for table consumption

For these reasons the production of duck eggs has not advanced in Australia to any marked extent (In Asia, duck production is more popular They lend themselves to village conditions in the well watered areas, duck eggs are widely eaten, and also ducks are not subject to diseases such as fowl plague—known as Raniket in India)

DISCUSSION ON BREEDS FOR TABLE PURPOSES

Muscovy, Pekin and Aylesbury ducks are the popular breeds for table purposes These breeds are also crossed to produce good quality ducklings

The Khaki Campbells have been suggested as a dual purpose breed, as they are a medium sized breed with laying ability, but not much heavier than Indian Runners The Rouen does not grow as quickly as the three above mentioned breeds

Muscovies are the most popular breed in Australia for table production, although Pekins are very popular in America and also England However they are not as popular under Australian conditions, as they are not prolific as breeders here This is important, as one of the heavy costs with raising ducklings is the large number of breeding stock that have to be carried over the year to produce ducklings for a limited season

In the United States the birds for the famous Long Island duck trade are all White Pekins In Holland the well known Jansen Farm carries Khaki Campbells

BRIEF DESCRIPTIONS OF BREEDS OF DUCKS

The following descriptions are given to enable identification of the various breeds and to give an idea of weights and characteristics For complete standards for exhibition purposes it is suggested that contact be made with the specialist clubs in the various States

INDIAN RUNNERS

This breed has a racy type head and wedge shaped bill The skull is flat on top and eyes are set high with an alert appearance The neck is long, fine and graceful, almost in line with the body, the head being slightly upward The body is slim, elongated, and round with upright carriage

When standing to attention the bird may be almost perpendicular or straight upright.

The weight of a drake should be 4 to 5½ lb. and the duck approximately 3½ lb. The main varieties are white and fawn and white but there are also fawn, black, and chocolate varieties. They are essentially suited to laying. They do not like nests and usually drop their eggs anywhere.

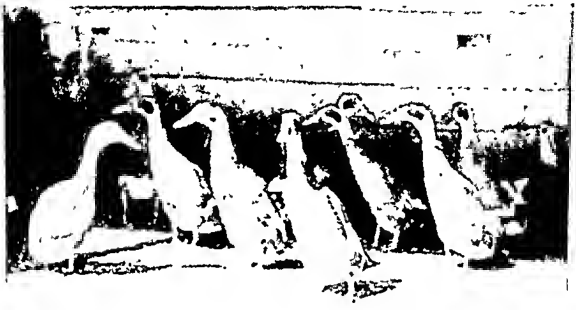

Fig. 182. Fawn and white Indian Runners. These are small ducks capable of good egg production. —(*By courtesy of Poultry*)

KHAKI CAMPBELLS

Khaki Campbells were bred from a Rouen drake and a fawn and white Indian Runner duck with an infusion of wild duck blood. This breed is regarded as a medium between the two above breeds.

The head should be fairly fine, bill of medium length and width with prominent eyes and alert appearance. The neck is medium in length, carried almost erect.

The body is compact but fairly deep and wide with well-rounded front. The back is medium length, fat, and gently sloping—abdomen well developed without sagging. The tail is short and rises slightly; the drakes usually have curled feathers. The body colour for the drake is an even shade of khaki and the head, neck, stern, and wing-bar bronze—a brown shade being preferable to a green bronze. Legs and feet dark orange and bill dark green. The duck is even khaki all over, back and wings being laced with lighter shade. Legs and feet body colour, and bill greenish black.

The duck should weigh 4½ lb. and the drake 4½ to 5 lb. The breed is only slightly heavier than the Indian Runner. (As with fowls, when the emphasis is on eggs the body weight must fall as compared with table breeds.)

Fig. 183. Typical Khaki Campbells. This breed is capable of good egg production and is slightly heavier than the Indian Runner breed.
—(*By courtesy of* Poultry.)

MUSCOVIES

This breed is of South American origin and has been bred for many centuries. It is one of the largest ducks known (it is the nearest relative of the African spurred goose). The other breeds are said to have originated from the mallard or wild duck. There are seven varieties, but the white is used almost exclusively for table purposes, because of the clean white appearance when dressed (the others are black, black and white, blue, blue and white, white winged black, and white winged blue).

One of the main features distinguishing this breed is the "carunculations" or fleshy protuberances over the base of the upper bill and the face.

Fig. 184. Muscovy ducks with ducklings. This is the most popular breed for table purposes. They make weights of up to 5 lb. for ducklings at 13 to 14 weeks, and up to 9 lb. for drakelings at 16 weeks when correctly handled.
—(*By courtesy of* Poultry.)

They do not quack, giving only a swan-like hiss. The expression of the face is fierce. They have a quiet temperament and do not lose condition by excessive exercise (although they can fly well.) The body of the drake should be powerfully built, broad, deep, and long with full rounded breast. The tail is long and carried low without any curled feathers at the tip.

The ducks are much smaller. The colour of eyes, legs, and beaks varies—and the eyes may be any colour from yellow to brown. The legs yellow, black, or mottled and the bill from flesh colour to yellow or black. The carunculations are mostly red but can be black.

The weight of a fully-grown drake is from 10 to 14 lb.—an adult drake measures over 30 inches in length: it walks slowly and heavily. The weight of a duck is from 5 to 7 lb.

PEKINS

The head of a Pekin is large and broad with a short, broad, and somewhat convex bill. The eyes are sunken and shaded by heavy cheeks. The neck is thick and long, with a graceful arch carried forward. The body is of medium length, but broad without any keel except a little between the legs, and the stern is carried just clear of the ground. The tail is well spread and carried high, the drakes having two or three curled feathers at top.

Fig. 185. Pekin ducks. —(*By courtesy of J.T.*)

The carriage of the Pekin is almost upright as distinct from the Aylesbury. The plumage is uniform buff, canary, deep cream, or white. The bill, legs, and feet are a bright orange, and the eyes dark lead-blue.

The drakes weigh about 9 lb. and ducks 8 lb. They produce a very nice carcass. The colour of the flesh is yellow and they grow quickly. (Pekins and Aylesburys are sometimes crossed to produce a quick-growing cross of good flesh colour and texture.)

AYLESBURYS

The head is large, long, and straight with a long, broad bill, being almost straight from the top of the skull, and measures 6 to 8 inches from the tip to the back of the head. The neck is slightly curved, long, and slender.

The body is broad, very deep and long with a prominent breast and the keel is quite straight The back is straight and almost flat The tail is short and only slightly raised, the drake having two or three curled feathers in the centre The carriage is practically horizontal with the keel, running almost parallel with the ground The plumage is pure white, the legs and feet bright orange, the bill pink, white, or flesh, and the eyes dark The drakes weigh about 10 lb and ducks 9 lb The colour of the flesh is white

ROUENS

This is the most ornamental and handsome of the domestic breeds The drake has a greenish yellow beak with the bean on the tip black The head and neck down to the white ring is a lustrous green, the ring should be clear-cut and almost meet at the back The breast is a rich claret colour and should be free from white lacing and clear cut The flank, sides, and stern are finely pencilled with black on a blue french grey ground, followed by rich black feathers up to the tail coverts, the curled feathers being a glossy green-black The shanks and feet are a rich deep orange colour The wing-bar is a broad purple blue band flanked on either side with a narrow band of black followed by a narrow band of white The back should be rich greenish black from the collar to the tail The duck has a general body colour of rich golden or chestnut brown, even in shade Feathers except the wing-bar and flight, are distinctly pencilled with black, and the feathers of the back wings and rump should be rich green sheen Wing bar same as drake The head is brown The bill is orange with a black splash in the centre Both drakes and ducks have a long and wide body, deep and square in keel with a good bow in front The body barely clears the ground They are only moderate layers and take longer to mature than the Aylesburys or Pekins, and have dark flesh Drakes weigh about 9 lb and ducks 8 lb

Fig 186 Rouen ducks

—(*By courtesy of J T*)

MULES

When Muscovies are mated with other breeds of ducks they produce hybrids or "mules", which do not breed The crossing produces a fast growing market bird, but the necessity to keep two separate breeds is a restriction to large scale breeding

MARKETING WEIGHTS FOR DUCKLINGS

MUSCOVIES

Muscovy ducklings when correctly fed and reared under good conditions should weigh about 9 lb for drakelings and 4 to 5 lb for ducklings ready for market Well-grown birds reach 1 lb more per head This gives an average weight of both sexes of 6 to 7 lb for market At this stage the tips of the wings begin to cross over the back and they still have downy feathers and the face has not lost feathers This "right time" for marketing is about 13 to 14 weeks for ducklings (4 to 5 lb) and 15 to 16 weeks for drakelings (9 to 10 lb) These weights are heavier than the other breeds and also this breed is more prolific If held longer the flesh becomes tough and has a stronger flavour (The use of hormones to improve texture of flesh as with cockerels is not successful with ducks) Also the economics question comes into the picture—feeding rates are too heavy to hold them longer than necessary or they can "eat the profits"

PEKINS AND AYLESBURYS

Pekins and Aylesburys are ready for market at 10 to 12 weeks, when they are known as "green" ducks At this age Pekins and Aylesburys if well grown weigh from 4 to 5 lb for ducklings to 6 to 7 lb for drakelings

Pekin ducklings and drakelings usually weigh more than Aylesburys, but the Aylesbury drakelings are nearly the same The average weight for market of both sexes and breed is about 5 lb, and in the case of well grown stock up to 6 lb This is not very far behind Muscovies, particularly for the Pekins At this stage the main wing feathers have finished growing, but are not hard in the quill These breeds are not as popular as the Muscovy, which is the breed mainly concentrated on in Australia, but Pekins have possibilities of development

AVERAGE GROWTH RATES FOR MUSCOVY DUCKLINGS

It may be of assistance to have an idea of the progressive average weights of Muscovy ducklings under good rearing conditions

	Ducklings	*Drakelings*
6 weeks old	2 lb	3 lb
9 weeks old	4 lb	5 lb
14 weeks old (ready for market)	5 lb (just over)	8 lb
16 weeks old		9 lb (ready for market)

Muscovy drakelings at 16 weeks old when fed on bran and pollard only cannot make the necessary weights or even maintain health Examples have shown weights for drakes only just over 5 lb at 16 weeks of age on poor unbalanced rations of this nature

Note Pekins will make nearly the same weights for ducklings to 9-week stage and slightly less for drakelings

POINTS ON MARKETING—CARE OF BIRDS

Care should be taken to see that ducks are marketed in good condition Keep in clean quarters some days prior to sending, to have them in clean condition Pick the ducks up by the wings when catching and handle carefully when putting in the crates—legs can be broken easily Do not hook them by the leg with a catching wire A crate should allow $\frac{1}{2}$ square foot floor space per duck (10 in a crate $2\frac{1}{2}$ feet by 2 feet), and $\frac{3}{4}$ square foot per drake (7 in a crate $2\frac{1}{2}$ feet by 2 feet) The height of crates should not be under 15 inches

A convenient way suggested of providing feed and water is to fix a large jam tin to the side of the crate, three quarters fill with soaked wheat, and then cover with water The wheat saves the water splashing, and if the wheat has been well soaked, a good supply of water is available to the ducklings

SUITABLE MARKETS

It is usually best to concentrate as much as possible on Christmas if selling on the auction market Other avenues, which depend upon the initiative of the operator, are to arrange a contract basis to supply suitable private markets or buyers with regular quantities at a contracted price

LIKELY COSTS AND RETURNS WHEN RAISING DUCKLINGS FOR MARKET

The raising of ducklings, as mentioned previously, requires the carrying of large numbers of breeding stock The feeding of these as well as the ducklings means that a considerable quantity of food is required

It can be worked out on the basis of the cost of carrying the breeding stock in relation to the number of ducklings raised per breeding duck—that is, debit each duckling with a proportion of the cost of carrying the breeding ducks and drakes over the year However, it is submitted that specialization has entered the field of raising ducklings

A clearer picture of costs may be given by assessing the purchase cost of day old ducklings Where these are available from sources specializing in this trade 30c per head could be allowed as day old cost If more or less is paid it means this adjustment can easily be made for returns The cost when producing on the unit will naturally be less (as the person selling reckons to cover costs, and show a margin for labour and profit), but one's own labour has to be taken into account in this case

In relation to feed costs a basis can be given that can be easily adjusted for any local costs (It is suggested that the approach to feeding be on the basis of using the right feeds—cheap refuse can mean poor growth and heavy losses in many cases Birds on a poor ration could weigh only half of the weights given for marketing)

As an example, with grain at $1 50 per 60 lb, bran and pollard at $40 per ton and meatmeal at $80 per ton, the average cost of a ration would be

2c per lb (Adjustment can easily be made for local costs when the cost of feed per pound is known)

Consumption of food can be allowed as a maximum at 30 lb of feed for Muscovies to 16 weeks If ducklings and drakelings of 7 to 8 lb average weight can be obtained for 28 to 30 lb of feed, it can be regarded as good feed conversion efficiency

The labour required with raising ducks is less than for cockerels, as a shorter time to marketing is required, but it is comparable with the time taken for raising "grillers" A suggested margin is 33 per cent on costs, but this is subject to market trends and the volume of business being undertaken A large turnover can mean success with a much smaller percentage of profit

Other charges to consider are the brooding costs and mortality loss A reasonable cost for brooding could be 5c per duckling If 10 per cent loss was experienced with ducklings, mainly in the early stages, this could mean with 100 ducklings as follows

10 ducklings at 30c day old	$3
Plus the 10 eating possibly 6 lb feed each at 2c per lb before being lost	$1 50

This would mean $4 50 spread over 90 remaining ducklings = 5c each to be carried by the remainder This covers all items (except depreciation and interest on the plant used)

To present these costs in concise form the following is given

For Muscovies

Costs	
Cost day old	30c
Brooding cost	5c
Mortality allowance	5c
30 lb of feed @ 2c per lb (approx)	75c
	$1 15
Plus approx 33% margin for labour	38c
TOTAL COSTS	$1 38

(exclusive of interest and depreciation)*

Marketing at 14 16 weeks average for ducks and drakelings

Returns

If averaging 6½ lb live weight at market ages the approximate returns would be

$1 30 at 20c per lb
$1 45 at 22c per lb
$1 60 at 25c per lb

This shows the margins ruling on the basis of these costs

In this case 22c to 25c per lb would be necessary for a good margin, but 20c per lb would cover costs with only a small margin for labour, thus demanding a bigger turnover in numbers raised

Note If an increase of 1 lb per head is obtained (20c to 25c more) or 2 to 3 lb of feed less used (5c to 8c saved) this means increased profit—this is a question largely decided by the operator s efficiency and the quality of the stock

If the desired weights are not attained the margin of profit could be wiped out

* Estimate of 2c to 8c per bird can be allowed, according to housing system needed, cost of land if range rearing, and if ducklings being raised over the full year

For Pekins (and Aylesburys)

Costs	*Returns*
As for Muscovies, except feed can be reduced to 20 or 22 lb as marketed at 10-12 weeks This would reduce costs by approx 20c to approx $1 plus 33% (approx 30c) for labour	If averaging $5\frac{1}{2}$ lb the returns would be
	$1 10 at 20c per lb
	$1 22 at 22c per lb
= total costs $1 30	$1 35 at 25c per lb

In this case 22c to 25c per lb would also be necessary, and the same comment re 20c per lb would apply if labour be covered as shown

Note No allowance has been made for any sidelines such as the sale of feathers—this can be a considerable item in some areas

The above indicates that Muscovies could be expected to show a better margin, particularly in view of the increased output of ducklings normally obtained per breeder duck, but could be closely followed by Pekins The margins are governed by the growth rate and feed cost as with all meat-raising projects, but it gives a basis upon which to work The use of the high-energy rations listed will keep feed costs to a minimum Variation can easily be made for local levels of prices for day-olds, cost of feed per pound and price received per pound live weight

DUCKS CAN BE MARKETED EARLIER

There is no reason why ducklings cannot be sold at earlier stages such as 9 to 10 weeks for Muscovies The percentage returns can be just as good in this case, because the heaviest feed consumption in relation to weight gains occurs in the last few weeks The position is similar to that between grillers and fully-grown cockerels The advantage of earlier marketing would apply, particularly if 9 or 10 weeks old at the time of the Christmas market

LOSS OF WEIGHT IN DRESSING DUCKLINGS

To assist the basis of calculations the loss in dressing ducklings is not as great with poultry A duck weighing $4\frac{3}{4}$ lb weighed $4\frac{1}{4}$ lb dressed (The mammoth duck-raising plants on Long Island with a very high degree of efficiency aim at 4 lb of feed to 1 lb of duck dressed weight)

If one can raise Muscovies with 27 to 30 lb of feed and obtain 7 to 8 lb or better live weight, or $6\frac{1}{2}$ to 7 lb dressed weight, then a high degree of efficiency is being attained

INFORMATION ON THE DRESSING OF DUCKLINGS

Ducks are dressed in much the same way as poultry They are usually killed and bled by the "sticking" method, or the neck is dislocated (Current American trends indicate a longer bleeding period—from three minutes to six minutes—to improve appearance)

Poulterers mostly dry pluck the birds, but the general practice where ducks are killed on the farm is the hard scalding process. This means immersing the duck in water about 190°F. long enough to loosen the feathers but not to discolour the flesh Try some of the body feathers at short intervals—as soon as they pull easily is sufficient time for immersion. (American practice now tends to semi scalding by immersing for 3 or 4 minutes at 138°F to 140°F.—mechanical plucking and dressing are also employed)

HATCHING, REARING, AND FEEDING DUCKLINGS

NATURAL INCUBATION

The type of nest to be used for a setting duck is important It should not be made too large, or two ducks may try to use the nest, and also it can mean that eggs are not kept tightly under the duck as the area is too great

A suggested type of nest is one made by cutting a kerosene-tin bucket down one side and opening it out to form a tent-like nest by attaching it to two pieces of timber 13 inches by 6 inches by 1 inch, one each end.

Sbavings can be used as nesting material plus feathers which a sitting duck uses to line the nest. This type of nest also prevents the eggs getting wet or being directly exposed to the sun It is suited for laying ducks, and a duck when setting The area covered is 13 inches by 13 inches If a duck has no access to water then damp the nest-box corner or sprinkle the eggs with warm water from 15th to 24th days and then when chipping starts.

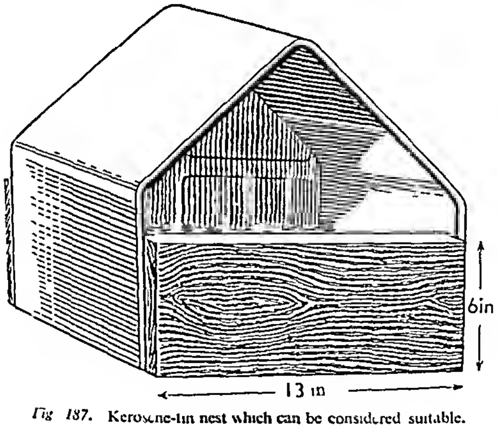

Fig 187. Kerosene-tin nest which can be considered suitable.

SUGGESTIONS FOR ARTIFICIAL INCUBATION

Eggs from Pekins and Aylesburys hatch quite well in incubators. Muscovies do not hatch as easily, although this depends on the operator—some have success. Eggs from Muscovies should be turned nearly full half circle. Others set eggs naturally under ducks or hens for about 10 days and then the remaining 25 days in the incubator. (Muscovies take 35 days to hatch; other breeds 28 days.) The main requirements are the temperature to be slightly lower than for hen eggs, and the humidity much higher, but percentages equal to hen eggs are not expected. The eggs should be under 7 days old, cleaned and handled carefully. They should weigh $2\frac{1}{2}$ to 3 ounces according to breed.

SMALL STILL-AIR MACHINES

Temperatures with thermometer bulb just clear of the eggs, first week 101°F., second week $101\frac{1}{2}$°, third week 102°, and 103° to 104° for remainder of period. Test eggs on seventh and twentieth days.

The humidity must be high—about 70 per cent for the first 24 days (a wet-bulb reading of 93°F. to 94°F.) then reduced to 60 or 65 per cent until chipping starts (wet bulb about 91°) and then increase again to about 70 per cent. Turning twice daily is carried out except for these last 4 to 5 days. Eggs can be cooled for a gradually increasing period until the last 4 or 5 days, with a maximum time period of nearly 30 minutes. The moisture tray usually needs to be kept filled to hold these readings. Some operators sprinkle the eggs during the last week to increase the humidity up to the time of the eggs chipping.

ELECTRIC FORCED-DRAUGHT MACHINES

The temperature can be held at about $99\frac{1}{2}$°F.—this usually gives the best results. The humidity should be high—about 70 per cent (wet-bulb reading 91°F.) and then reduced to 60 or 65 per cent (wet-bulb reading 88°F.) and then increase to 70 per cent when chipping starts. Turn at least twice daily up to within 4 or 5 days of hatching time. Test at 7 days and 20 days. (Follow the maker's recommendations for the particular make of machine in relation to duck eggs.)

Note. Reference is made in Chapter 9 to the general handling practices for incubator operation. The main variation for ducks is in the higher level of humidity required as compared with hen eggs.

REARING DUCKLINGS

Ducklings can be raised in brooders as set out in Chapter 10 Muscovy ducks should not be wasted on rearing ducklings but used for hatching if large numbers are desired The only proviso is that double the space must be allowed in a brooder as compared with chickens

In battery brooders one-third of a square foot per duckling to one month is needed, and for floor brooders, infra-red or hover type, allow 1 square foot per duckling of shed space plus outside run With hover brooders provide a little more headroom than for chickens.

Employ the same methods in relation to litter, which can be up to 4 or 5 inches deep Care is required up to one month of age—avoid ground draughts as with chickens to prevent any possibility of chilling The temperatures after a week can range a little lower than for chickens The ducklings should not need heat after four weeks

Stir the litter, as the ducklings do not scratch like chickens, and remove "caked" portions The litter must be kept dry Confine close to the brooder as with chickens for the first few days

WATER

Water-supply for ducklings is important (and *it must be constant*) It needs to be about 2 inches deep up to two or three weeks, and then 5 to 6 inches deep Shallow vessels, which prevent them from washing their heads and beaks and eyes thoroughly, will cause sore eyes

The water vessel must also be placed on a small grid or convenient platform so that wet patches cannot develop around the waterer—ducklings are much more difficult than chickens in this respect (A waterer on a grid placed over a tray can be used) A grill should be used to prevent ducklings getting into the water during the first two or three weeks This can prevent heavy losses due to chilling (Ducklings should not be allowed in ponds or waterers until fully feathered This differs from adult stock)

The supply must be ample so that the ducklings do not have to crowd together to get a drink Should water run out even for a short period heavy mortality can result, with staggering and convulsions as symptoms, if

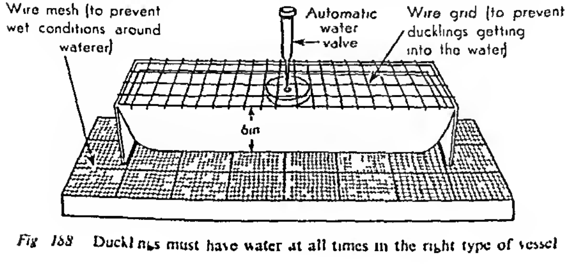

Fig 168 Ducklings must have water at all times in the right type of vessel

food is eaten before or soon after the supply is replenished (This type of staggers differs from that which occurs owing to lack of shade in hot weather Avoid this by having ample shade—natural if possible—and water available without ducklings having to travel across open spaces to it)

It is stressed again that water for ducklings is very important—the vessel must be deep enough to permit immersing their heads without the ducklings getting into the water, it must be placed so that the "drips" are caught to prevent wetting the litter, and supply must be constant at all times day and night, and be kept clean and cool

FEEDERS

The feeding (also water) vessels must allow ample space—double the space for chickens (See pp 180, 208, 472-3) It is preferable that these also be placed on a platform or grid to keep the litter in good condition Ducklings foul their surroundings quickly if the feed (and water) arrangements are inefficient

REARING DUCKLINGS AFTER BROODER STAGE

Ducklings can be held in rearing-sheds following on the brooding stage of up to four or five weeks They are usually hardy after this stage They do well held in lots of about 50 to 60 A shed 12 feet long by 6 feet deep would be ample for this number The height is to suit the convenience of the operator Five feet in front down to 4 feet at back can be used or 1 foot higher back and front if desired The shed should face north and be enclosed on three sides—the front to be closed up nearly half-way A ventilation gap (with hinged board) under the roof at the back should be provided

A curtain can be used in the front if the weather is rough for the first few nights when the ducklings are moved in

(The 12-foot by 6 foot chicken-rearing shed in Chapter 11 could be taken as an example)

A concrete floor is very desirable for this shed when used for ducklings in order to maintain a sanitary condition It should have litter to a depth of a few inches to be kept stirred (and changed) as required Runs should be provided for each shed which should contain about 100 square yards Ample shade is needed Almond or orchard trees are ideal The fences need only be 2 to 2½ feet high Ducklings should be closed in at night, and particular care should be taken that they are kept dry in wet weather until they are feathered It is vital that a constant supply of water be available inside the house and that the same arrangements for depth of water, and having the vessel on a grid or platform to stop wet surroundings must be observed as referred to for the brooder house

FEEDING DUCKLINGS

The feeding of ducklings will be the main factor in enabling them to be marketed at the earliest possible stage The ration should contain an adequate protein level to keep up with the rapid rate of growth expected

It is strongly stressed that bran and pollard only will not give sufficient growth, and leg weakness is likely to develop, combined with producing birds without flesh and with poor frames Table refuse (which may cause food poisoning) and stale bread only are poor feeds and can give similar results If bread is available cheaply it can be balanced correctly and give good growth as follows Add 1 lb meatmeal and ½ lb milk powder when 10 lb of bread replaces 10 lb of bran and pollard, or when 20 lb bread replaces 20 lb crushed grain to maintain balance in the ration fed Small operators could use a 20 per cent protein prepared hen breeding mash with some grain (2 of mash to 1 of grain by weight) or chicken mash to 4 weeks, then 15 per cent protein breeders mash to marketing, plus greenfeed

Various Methods of Feeding

1 *Pelleted feeds* (granules or crumbles) correctly balanced and containing 17% protein to 4 weeks, and 15% protein to marketing, give excellent results with ducklings In U S A large numbers of ducklings are raised on these feeds The ducklings can handle pellets easily This method saves on labour compared with wet mashes

2 *Dry mash* Available free choice at all times day and night as the full ration to 3 weeks, then continue at rate of 2 parts mash to 1 part grain, to market stage A mixture of 20 lb pollard (1—4 gallon bucket), bran 15 lb (1¼—4 gallon bucket), 35 lb crushed wheat (1⅔—4 gallon bucket), 10 lb crushed oats (⅔—4 gallon bucket), 9 lb meatmeal (50% protein) (⅓—4 gallon bucket), 6 lb milk powder (⅜—4 gallon bucket), 5 lb lucerne meal (⅓—4 gallon bucket), ½ lb salt, ¼ oz manganese sulphate and 1 oz 10,000 A, 2000 D_3 powder (or equivalent oil emulsion level) *Feed greenfeed in addition* if possible—if not add 1 p p m synthetic riboflavin If lucerne meal also not available add ½ lb meatmeal and further 1 p p m synthetic riboflavin but include lucerne meal if possible

3 *High energy all mash* To convert the above dry mash with a consequent saving of feed consumed replace the bran and pollard with equal weight of crushed grain and make the following adjustment Add 3 lb meatmeal, ⅛-¼ oz. manganese sulphate and 1-2 p p m synthetic riboflavin

4 *Wet mash To be fed as* 3 *parts mash to* 1 *part grain by weight* 54 lb pollard (2¾—4 gallon buckets), 26 lb bran (2⅙—4 gallon buckets), 9 lb meatmeal (⅓—4 gallon bucket), 5 lb milk powder (⅓—4 gallon bucket), 5 lb lucerne meal (⅓—4 gallon bucket), ½ lb salt and 2½ oz oil emulsion, 5000 A, 1000 D_3 per gramme Mix to a crumbly consistency Sufficient can be fed at each time (3 or 4 times daily) to be cleared up within an hour If skim milk is available to mix the mash, milk powder can be left out

Feed greenfeed in addition if possible—if not add ¼-1 p p m synthetic riboflavin Part of the grain can occasionally be given soaked

Give shell grit, hard grit and charcoal given as free choice at all times This can be used with all rations (Some operators arrange night feeding with lights to stimulate growth—and save feed losses due to feed eaten by flying birds)

Note For simple feeding of all ages, from day old to adults, refer to p 648, Appendix 1 for use of one simple concentrate basis

GREENFEED

The greenfeed given to the ducklings should be young finely chaffed and of high quality Ducklings should be fed as much as they will eat except for the last 2 or 3 weeks when it can be restricted Vitamin A supplement in synthetic form is also needed in all mashes with ducklings even when ample greenfeed is available

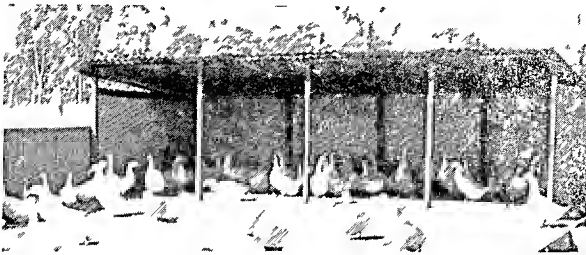

Fig 189 Suitable house for ducks with a yard attached and fences 2′ high This house is 16′ long and 9 deep, and the front is 5 high and the back 4 high

HOUSING ADULT DUCKS

Adult ducks do not require elaborate houses A shed of the type described for the rearing-shed (12 feet by 6 feet would hold 25 to 35 breeding ducks on the basis of 2 to 3 square feet per bird) Nests can be placed along the back of the shed, two nests for three ducks The floor is best covered with litter, and the shed must be kept dry The location should be in the shade of trees if possible Lack of shade in hot weather will kill birds through sunstroke

DUCKS IN THE ORCHARD

Ducks are well suited to orchards—ample shade is available and they are of considerable help in controlling insect life and snails They fit in very well in this sphere (and where creeks, streams or dams exist) The location should be a well drained situation and if possible a sandy soil Sanitation is very important avoid overcrowding the area The area given should not be under ¼ acre for about 100 ducks if possible

Note The question of shade for the house and the run to avoid staggers and sunstroke, and the provision of water available for drinking in the house and outside at all times (as for ducklings) is again stressed as vital to avoid heavy losses

SWIMMING PONDS OR A CREEK FOR BREEDING DUCKS

A pond or creek is desirable for Aylesburys or Pekins for improved fertility and for exercise They should not be allowed on the water until

they have laid for the day or many eggs may be lost in the water Muscovies can be raised without a pond or creek, but the water vessels must be deep enough to fully immerse their heads

SELECTING BREEDING DUCKS AND DRAKES

The selection of breeding ducks is on the lines adopted for any meat stock They should be well grown for their age If selecting Muscovies at about fourteen weeks of age for future breeders the ducks should weigh not less than 5½ lb and a drake should weigh not less than 9 lb at this stage Select the earliest maturing birds

When commencing the breeding season ducks should weigh about 6 to 7 lb and drakes about 11 lb These weights would rule for eight months of age Size is the big factor in selecting drakes

In addition it is desirable that something be known of the background of the drakes as to whether they are bred from a duck that laid sufficient eggs for the season (and, if possible, something of the performance of her half-sisters) The same rule should also be applied to breeding ducks

The birds should be typical of the breed, comply fairly closely with the standard, and not be too closely related Young drakes are likely to give the best fertility, particularly early in the season Good old drakes that have shown ability as breeders should not be lightly discarded, but a heavy culling for age is desirable The number of breeding stock to be carried demands that as many ducklings per breeder be obtained as possible during the season It is possible to use a young drake early in the season while the old drake is moulting, and then use the older bird for the production of good breeders later in the season (about August onwards)

MATING—FLOCKS VERSUS SINGLE PENS

It is usual to mate six or eight ducks with a drake Pekins and Aylesburys are successfully flock mated in large numbers

Muscovies are also bred successfully when mated in flocks except where trouble may be experienced with young and old drakes together In these cases it may be necessary to have individual pen matings

Fertility is usually better in the flock matings when the drakes do not fight excessively

APPROXIMATE LAYING SCHEDULE FOR MUSCOVY DUCKS COVERING FIRST, SECOND AND THIRD YEAR

A duck could be expected to commence laying at about 7½ months of age The first eggs are not likely to produce good ducklings, hence they should not be used If arrangements are made for artificial brooding of the ducklings to avoid the time required if cared for by the duck herself, it is possible to obtain 60 to 70 eggs from a first year duck With reasonable hatching over 40 ducklings could be obtained per breeding duck The supply could be spread from July to April A second-year duck would lay less and about 30 ducklings could be expected from over 40 eggs The supply could be spread from August to April A third-year selected duck

could also be expected to produce about 30 ducklings from approximately 40 eggs with supply from August to April Breeding ducks should not be kept beyond three seasons Breeding stock can be selected from the best of second and third year birds If using young stock as breeders then select for early maturity for growth in drakes and egg lay with ducks (Pekins could normally be expected to produce about 15 to 25 ducklings in a season These times apply for Australia)

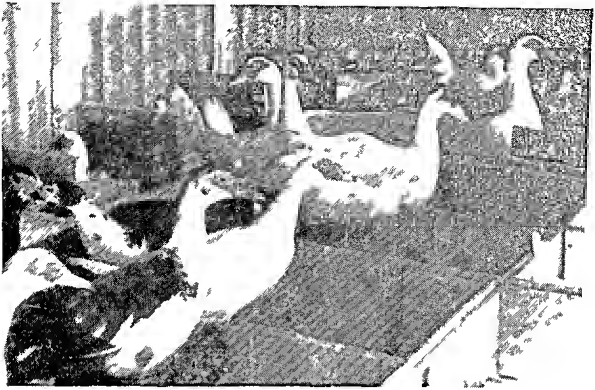

Fig 190 Muscovies inside a suitable shed with open, box type nests for laying

FEEDING OF BREEDING DUCKS

First-year egg production of well over 300 eggs was being obtained in the 1920 s in Australia (Indian Runner ducks—*not* table ducks) The feed at the South Australian duck competition in 1929 (with many scores over 300 eggs and up to 123 for 122 days winter test period) was as follows

"Wet mash of two parts pollard, one part bran plus $1\frac{1}{2}$ to 2 lb of meat-meal per 100 ducks daily fed morning and evening To this was added 60 per cent chaffed greenfeed lucerne for preference During the winter $1\frac{1}{2}$ lb pea meal added per 100 ducks Two oz of grain was fed at midday (2 parts wheat, 1 part barley) placed in the drinking water Short oats were used during the summer in place of the barley

"The feeding in the water was to keep the eyes and head clear (and also prevent wheat being eaten by the sparrows) '—*Reference* H Manfield

The feeding system used by some operators today does not vary a great deal from this A wet mash is fed morning and afternoon It is suggested that labour can be reduced by feeding a wet mash only in the morning or using dry mash entirely

SUITABLE BREEDING RATIONS FOR DUCKS

Mash and Grain 50/50

Wet mash Could be 51 lb pollard ($2\frac{1}{2}$—4 gallon buckets), 27 lb bran ($2\frac{1}{2}$—4 gallon buckets), 10 lb meatmeal (50% protein) ($\frac{2}{5}$—4 gallon bucket), 6 lb milk powder ($\frac{3}{8}$—4 gallon bucket), 5 lb lucerne meal ($\frac{1}{3}$—4 gallon bucket), $\frac{1}{2}$-1 lb salt, $\frac{1}{8}$ oz manganese sulphate, 4 oz oil emulsion, 5000 A, 1000 D_3 per gramme (or powder equivalent)

This is fed with an equal weight of grain—1 part mash to 1 part grain

It is important for hatchability that the riboflavin level be maintained by using the milk powder Feed greenfeed also and give shell grit free choice (If greenfeed unavailable add synthetic riboflavin—2 p p m)

Dry mash To be fed 2 parts mash, 1 part grain—100 lb mash with 50 lb grain

A suitable mixture would be 20 lb pollard (1—4 gallon bucket), 20 lb bran ($1\frac{2}{3}$—4 gallon bucket), 32 lb crushed wheat ($1\frac{1}{2}$—4 gallon bucket), 10 lb crushed oats ($\frac{3}{5}$—4 gallon bucket), 8 lb meatmeal (50% protein), ($\frac{1}{3}$—4 gallon bucket), 5 lb milk powder ($\frac{1}{3}$—4 gallon bucket), 5 lb lucerne meal ($\frac{1}{3}$—4 gallon bucket), $\frac{1}{2}$-1 lb salt, $\frac{1}{4}$ oz manganese sulphate, $1\frac{1}{2}$ oz powder containing 10,000 A, 2000 D_3 per gramme Also feed greenfeed and give shell-grit free choice (If no greenfeed, as above for wet mash)

Note The grain can be given in a trough in water Ducks don't scratch as do hens The soaked grain can help cover possible vitamin E deficiencies

High Energy All mash To be given as free choice—no other grain (but greenfeed can be given) Shell grit free choice 72 lb crushed wheat ($3\frac{1}{4}$—4 gallon buckets), 10 lb crushed oats ($\frac{3}{5}$—4 gallon bucket), 8 lb meatmeal (50% protein) ($\frac{1}{3}$—4 gallon bucket), 5 lb milk powder ($\frac{1}{3}$—4 gallon bucket), 5 lb lucerne meal ($\frac{1}{3}$—4 gallon bucket), $\frac{1}{4}$-$\frac{1}{2}$ lb salt, $\frac{1}{4}$-$\frac{1}{2}$ oz manganese sulphate, 1 oz powder containing 10,000 A, 2000 D_3 per gramme, $\frac{1}{2}$-1 p p m synthetic riboflavin (vitamin B_2)

Breeding pellets (17 to 18 per cent protein) can be fed to ducks with success, plus some soaked grain (pellets to grain 3 to 1 by weight), alternatively use 15 per cent protein pellets without grain and ample greenfeed The pelleted ration saves considerable labour and gives efficient results

The above gives a choice of varied rations—main requirements are sufficient protein in the feed—this is most important—plus sufficient vitamin A, B_2, and D_3 Bran and pollard only will not give growth or hatchability Grain can be varied—barley could replace some of the wheat Skim milk can replace the buttermilk powder and the feed must be sufficient at all times (approximately twice hen rates) Also water must be available day and night, also ample shell-grit, hard grit, and charcoal (See reference Appendix 1 p 648 for feeding also)

SCRAPS AND REFUSE FOR FEEDING DUCKS

Many people have the impression that adult ducks can be fed on large quantities of stale bread, restaurant or kitchen scraps, or wastage mixed with some bran and pollard

If care is taken to use only selected scraps and the whole is boiled, plus sufficient protein, this may be successful The only reliable way is to feed a properly balanced feed as suggested above to obtain good growth and hatchability A grave risk also taken with refuse feeding is that enteritis may be caused with heavy mortality

TABLE 24*

NUTRITIONAL REQUIREMENTS FOR DUCKS

Age	*Protein*	*Calcium* %	*Phosphorus* %	*Manganese* p p m	*Riboflavin* p p m	*Vitamin A Units per lb*	*Vitamin D_3 Units per lb*
Day old—3 weeks	17	1 0	0 6	60	4 0	2000	140
3 weeks onwards	15	1 0	0 6	60	3 0	2000	140
Breeding stock	15	2 5	0 8	40	3 0	3300	450

DISEASES OF DUCKS

Ducks do not suffer from a large number of diseases, but owing to their rapid growth any deficiencies in feeding show up more quickly than with chickens They are sensitive to salt poisoning and the use of poor rations

DISEASES DUE TO POOR QUARTERS

Where ducks are kept under wet and sloppy conditions without a dry shed or area, plus overcrowding, then trouble can be expected Lack of ventilation and sunlight will play havoc Dirty ponds can cause food-poisoning Lack of shade in hot weather and water out in the sun will cause heavy losses through staggers Counteract the effect of heat as much as possible by having water under shade and plenty of room for all ducks to share the shade Ducks as sideline on open range with water area usually do well, as surroundings are clean

Lack of water If the supply of water has run out through accident or neglect do not feed the ducklings This will cause heavy losses with symptoms of staggering Giving warm milk as the first drink, followed by small amounts of cool water (small amounts of water only will work if milk is not available) and not allowing food for some time will prevent these losses

It is important that ample water be provided day and night for ducklings and ducks It is stressed again that waterers must be of sufficient depth

* Reference Table for nutritional requirements of ducks vide G L McClymont and M W McDonald from *Scientific Poultry Feeding*

(with a suitable grid to prevent ducklings getting in the water) to avoid sore eyes

MOULDY FOOD AND DIRTY, DAMP CONDITIONS CAUSING MYCOSIS, BOTULISM OR ENTERITIS

Food which is mouldy will cause mycosis or botulism Clean, fresh food only should be given to avoid heavy mortalities, which can occur in this way Enteritis can also be caused by the feeding of refuse foods such as stale bread and decomposed garbage Laboratory diagnosis would be necessary to determine which disease applied Affected ducks should be destroyed The yards will need spelling for a long period after disinfection, and cleaning up will be necessary

DISEASES DUE TO DEFICIENCIES IN FEEDING

Vitamin A Deficiency (sometimes known as "Wet Eye") in Ducklings

This is quite prevalent with ducklings Symptoms are "staggers", a discharge from the eye, followed by paralysis Even with good supplies of greenfeed this trouble can occur, as the vitamin A requirements of the ducklings are high Even with ample good young greenfeed the best results in growth and health cannot be obtained without the addition of extra vitamin A The use of whole milk to mix the mash would help with vitamin A supply The rations given in this chapter have an adequate level Other predisposing causes for this trouble are dirty and damp quarters, insufficient shell grit and charcoal, allowing ducklings to get wet, and shallow waterers Correct husbandry and ample greenfeed plus a sufficient level of a vitamin A supplement in the ration will prevent this problem

Vitamin D Deficiency (known as Rickets)

Ducklings will develop rickets rapidly Symptoms will be as for chickens with loss of the use of legs and poor bone condition The requirements for vitamin D are comparable with chickens owing to rapid growth and greater size The addition of vitamin supplement as above when the product contains vitamin D_3 as well would cover all requirements The level of calcium and phosphorus (bonemeal or the bonemeal portion of the meatmeal usually provides this) must be sufficient Sunlight will supply this vitamin in the natural form, but the addition of the extra vitamin D_3 is needed to cover all weather conditions

Riboflavin (Vitamin B_2) Deficiency

The required level is above that for chickens Ample greenfeed and the inclusion of the milk powder (or the use of milk or skim milk to mix a wet mash) will safeguard against this trouble Synthetic riboflavin can be used in addition Breeders also must have an adequate level

Vitamin E Deficiency

Ducklings are unable to turn over if placed on their backs, tremble and turn feet inwards The normal rations shown should prevent this trouble

The soaking of the grain also helps the vitamin E level In cases of outbreaks wheat germ should be fed, or synthetic vitamin E be added to the ration

White Eye

The cause is unknown, but many cases suspected as white eye have been found to be "wet eye" due to vitamin A deficiency The symptoms of "white eye" are "staggers", and in many cases death occurs rapidly Birds that live for a longer period have a white film form over the eye The disease appears highly infectious The susceptible ages are four days to eight weeks The symptoms can be confused with vitamin A deficiency Affected ducklings should be isolated as noticed Treatment of eyes—of those lingering—with 2 per cent zinc sulphate can be carried out The likelihood of this complaint emphasizes the need for a high level of vitamin A as a possible safeguard This complaint has caused very heavy mortalities with duck raisers Check for diagnosis

Sinusitis

A typical symptom is a puffy swelling under the eye Ducks can be affected with sinusitis like turkeys Deficiency of greenfeed lowers resistance Lack of shell-grit, charcoal, and hard grit also predisposes to the complaint Treatment should be attempted only by a qualified person

Cholera

Wet, cold, and filthy conditions predispose to this trouble Ducks affected tire easily when walking and have a generally poor appearance, and the joints may be affected Losses can be mild to fairly heavy Prevention by good husbandry is the best safeguard—the use of sulpha drugs assists with affected birds

OTHER DISEASES

Tick fever Ducks are affected by tick fever as with poultry, although owing to their restless nature and (normally) non-roosting habit they do not contract it as readily as poultry The same control method for handling tick eradication as for poultry should be used, also vaccination against tick can be carried out

Staggers Ducklings will suffer from staggers with vitamin A deficiency or tick fever—but other causes as listed elsewhere are food being given after water has run out (or lack of shade in hot weather—sunstroke will cause many deaths) It is stressed that if water should run out warm milk (if possible) be given first, or water in small lots, and food withheld until some time has elapsed

Pullorum disease will affect ducklings (Blood test as for poultry)

Coccidiosis will also affect ducklings Control as for chickens with correct feed and dry conditions and if necessary suitable drugs

Poisoning will occur as with poultry—and ducklings cannot tolerate as much salt as chickens

Pneumonia will be caused on the same lines as chills if ducklings are in wet conditions or can get into their water vessels

Note Most of the troubles with ducklings can be avoided by the provision of good dry quarters, ample water day and night in the right kind of waterer, and well balanced feeds such as those set out in this chapter

SUMMARY

1 Ducks are more suited for table purposes than for egg production in Australia, in view of the market preference for hen eggs, but are popular in many parts of Asia in suitable areas

2 The Muscovy duck is the most popular breed for table purposes with the Pekin next for preference The quality of the breeding stock is important for quick growth in ducklings and drakelings Selection methods are indicated

3 The economics of the suggested basis for costs and returns should be carefully studied to see if the market prices available are sufficient for a reasonable profit

4 Natural or artificial methods of incubation and rearing which can be used are described

5 Ducks can be handled with simple quarters, and can fit in well as a sideline on mixed farms and orchards and well watered range areas

6 The feeding rations must be correctly balanced to market well grown ducklings and drakelings Suitable rations are listed The levels of greenfeed and protein are particularly important, and adequate water (both day and night) is very necessary (See Appendix 1 for feeding also)

7 *Diseases of ducks can be controlled to a large extent by providing* the right conditions and a correct feeding ration

Acknowledgment is made for reference matter on duck diseases from *Diseases of Poultry* by T G Hungerford, where complete information is available

Also for some material from a comprehensive leaflet No 1057 "Muscovy Ducks", by R H Morris, Officer-in Charge, Poultry Branch, and H Cole, Poultry Instructor, Department of Agriculture, Western Australia

CHAPTER 21

GEESE

GENERAL POSSIBILITIES

GEESE have not been very popular throughout Australia, although some very fine geese have been bred in the Commonwealth Interest has increased recently, and some general information is given on the various aspects of handling geese

The increased interest in geese as a meat is possibly occurring because of the preference of newcomers from Europe for goose meat, where it is much more popular than it has been here The price usually paid per pound is likely to be below that of turkeys or grillers, but geese grow rapidly and with ample grazing facilities can exist almost entirely on good pastures This gives a lower production cost than with other forms of poultry meat A reasonably payable market, particularly around the Christmas period, should exist

Another avenue is selling stock It would seem that possibilities exist for vegetable gardens, farms, and orchards, also a reasonable market for stud geese should be available The ordinary farm grey goose does not compare with the popular breeds and has evolved from a mixture of a number of breeds

Geese do not require a great deal of attention and are hardy and disease-resistant They are also a pleasant sight on a farm and can exist without housing The majority of geese are raised in small flocks on general farms They also have a value as a source of manure, and can be run on any area where land that could not be utilized otherwise is available, such as rough land along a creek The use of good green pasture for geese could be assessed against the return from other forms of livestock In small numbers they do not show a marked effect on pasture or range, but if concentrated on small areas will eat out the grass Do not graze more than approximately twenty to twenty five adult geese to the acre, and for light grazing three or four geese per acre Growing geese can usually be raised for market with very little shelter, but a dry camping area is desirable They will not do well on dry pastures—supplementary feeding would be necessary Geese are also handy as "watch dogs"—ganders "standing up" as it were and showing resentment when strangers or dogs approach They also serve a very useful purpose in weeding orchards and various crops Geese have been used among strawberry plants until the berries are nearly ripe—and also extensively among cotton crops in the United States

POPULAR BREEDS

Breeds common in Australia are Toulouse, Embden, African, and Chinese, but there are other breeds The most popular are Toulouse and

Embden by virtue of their size, but African and Chinese may become quite popular as they lay more eggs than Toulouse or Embden and mature rapidly. Well-bred birds will pay best, as with all lines of poultry, therefore buy from a good line of stock when commencing breeding.

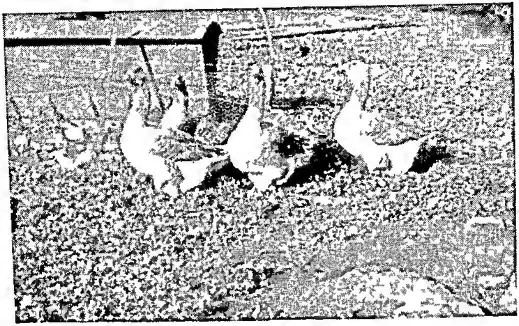

Fig. 191. Toulouse geese, a popular and well-known breed.

TOULOUSE

The Toulouse is the heaviest of the breeds of geese. Mature stock at nearly twelve months weigh up to 25 lb. for ganders and 19 to 20 lb. for geese. (The Mammoth Toulouse, bred mainly for exhibition, will weigh more than this and the standard here also calls for a dewlap or fold of skin under the throat.) Young ganders will weigh up to 18 or 20 lb. and young geese 14 to 16 lb. Goslings can be marketed at ten to thirteen weeks of age as green geese and will usually weigh from 11 to 14 lb.

Description: This breed has a broad, deep body and is loose feathered, which gives it a massive appearance. The colour of plumage is dark grey on the back shading gradually to light grey edged with white on the breast, and to white on the abdomen. The female resembles the male but is smaller. The geese are fair layers only, giving usually about twenty to thirty eggs per year. They are docile and grow well. The dark pin feathers are a deterrent in some markets.

EMBDEN

The Embden follow Toulouse in weights. The ganders can be crossed with other breeds such as Chinese and produce good goslings. Mature stock will weigh up to 20 lb. for ganders and 18 lb. for geese. Young ganders 18 lb. and young geese 16 lb. Well grown goslings can be marketed weighing 10 to 12 lb. at nine to twelve weeks of age as green geese. They are considered more suitable for hot areas than Toulouse.

Description The Embden is a large white goose, more active and more tightly feathered than the Toulouse The plumage is pure white The geese are fairly good layers, depending on the strain Thirty to forty eggs may be obtained in a season They are usually better sitters than Toulouse This breed is popular for market, maturing early, and has white pin feathers

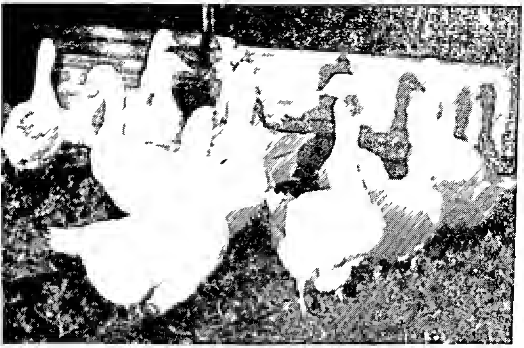

Fig 192 Embden geese, another well known breed

AFRICAN

The African approach the Embden in weight Adult ganders weigh 18 to 20 lb and geese 17 to 18 lb, but the young weigh less than young Embdens, being about 16 lb for young ganders and 14 lb for young geese They are good layers and grow well Marketing weights are 9 to 10 lb at ten to twelve weeks of age as green geese

Description The African is a grey goose with a distinct brown shade It has a distinctive knob or protuberance on its head and carries a dewlap as with the Toulouse Its carriage is more erect than the Toulouse and the body is nearly oblong and higher from the ground They are a handsome breed with head knob and bill black, plumage ashy brown on the wings and back and light ashy brown on neck breast, and underside The dark pin feathers may be a deterrent to market demand

CHINESE

Chinese geese are much smaller than other breeds, but owing to moderate size for marketing for household consumption, early maturity, and good early laying, they are likely to become popular The raising of Chinese geese is easier because of better fertility and hatching than with the larger breeds This type grows rapidly, being of an active nature, and is a desirable small goose for market Green geese can be marketed at 8 to 10 lb at ten to twelve weeks of age

Note: Crosses between these breeds grow well and hatchability and fertility are very good.

Description: White Chinese geese have pure white plumage and an orange-coloured bill and knob. They are swan-like in appearance, as also are Brown Chinese. Brown Chinese have a russet-brown colour that is lighter on the underside of the body, a brown head, dark slate or black knob, and black bill. They lay forty to sixty eggs in a season and White Chinese usually lay much earlier than the larger breeds. They are popular for exhibition and as an ornamental breed, as well as being a good market proposition.

Fig 193 A flock of Brown Chinese geese. These are smaller than the Embden or Toulouse breeds, but mature quickly; also they lay more eggs and give better fertility.

MANAGEMENT OF GEESE

Geese are normally raised in flocks on general farms, not being specialized in as with poultry. Possibilities regarding stud stock have been referred to, and market demand should expand. Geese are very little trouble, and given good pasture their diet can consist mainly of grass, but the addition of laying mash as for hens is needed to promote earlier egg production and improve weights. Where some natural shelter is available no housing need be provided. They graze closely, hence the need for ample range—they will kill grass if concentrated too heavily, and will not then be as free of disease troubles as geese normally are. They do well on stubble also, but extra feeding will be necessary.

A running stream or a pond is desirable for good fertility, during the breeding season, particularly with Toulouse, but good breeding results have been obtained without bathing facilities. Geese are capable of defending themselves vigorously from foxes, except when the foxes hunt

in packs, in which case deaths have been reported In these cases some night protection would be necessary. Some breeders have reported that no trouble with foxes has occurred over very long periods

NESTS AND SHELTERS

Heaps of boughs or bushes are suitable, but a shelter such as half a tank has been used. Alternatively it can be used to make a large nest about 2 feet 6 inches in diameter with some stones at the open edges to hold nesting material such as straw Feed and water should be provided close to the nest There should be a nest for every three geese They will sometimes prefer to lay outside A large packing case with the open end to the ground and a fairly large opening cut in one end makes quite a good nest.

PRACTICES FOR BREEDING WITH GEESE

Medium-sized birds are best for breeding Select birds that are good bodied and *matured early*, and retain matings proved as long as they are capable of producing good stock Females will lay until they are ten years or more and ganders can be kept for five years Geese can live up to twenty years Younger females will usually lay more eggs, but disappointment will be frequently experienced with young birds under two years old owing to poor hatching results Breeders should be from older stock If young geese are used, mate with old ganders Geese are very slow to mate with new birds Some ganders will mate with only one goose while others will mate with more than four geese Ganders of the smaller breeds can be mated with more females than the heavy breeds Once successful matings are made, leave them together as they will pine and lose weight if the matings are broken up This can be a matter of luck from the farmer's viewpoint—if eggs from particular geese are infertile, additional matings may have to be made If ganders and geese are reared together there is more chance of getting flock matings to succeed

DISTINGUISHING SEX IN GEESE

It is difficult to distinguish sex in geese Identification is usually easy when mature because the gander is larger and when geese are laying the width of the pelvic bones (as with hens) and the soft condition of the abdomen are a reliable guide The gander will always stand up if disturbed, say, by a dog, and has a shrill, high-pitched note compared with the lower, deeper and harsher note of the goose Examination of the sexual organs will show a folded or wrinkled muscle with pressure around the vent of the female, while in the gander the stretched muscle will be smooth and the sexual organ will protrude In day-old goslings when the cloaca is inverted the day-old gander has a distinct whitish papilla about $\frac{1}{8}$ inch long, which is only rudimentary in the day-old goose

FEEDING BREEDERS

Breeders may obtain requirements on pasture, but to bring them into lay at the end of winter or early spring and to produce the highest possible

number of eggs that will hatch well, a breeding mash containing about 18 to 20 per cent protein—as used for breeding hens should be fed Refer to Chapter 14—mashes for breeder hens—the crushed grain ration would be best Pelleted mash as for breeders can also be used A mixture of oats, wheat, barley, and/or other grains should also be given Up to $3\frac{1}{2}$ to $4\frac{1}{2}$ oz mash and $2\frac{1}{2}$ to $3\frac{1}{2}$ oz grain daily per bird could be given Geese can also be fed with all mash—use the 15 per cent protein high energy breeder all mash in this case Place dry in a hopper

Note If greenfeed is unavailable for the geese with dry conditions, feed lucerne chaff with the mash and grain referred to above or make bales of lucerne hay available Shell grit and hard-grit should be available to geese as for poultry

If desired to maintain egg production and break up broodiness, act promptly when a goose becomes broody, confine her in a pen or a slatted-bottomed crate for four to six days away from, but in sight of, the ganders

STARTING A FLOCK

The methods normally used are purchasing adult breeding stock, day-old or started goslings where available, or hatching eggs Most ordinary farm flocks are produced by natural incubation and brooding The use of incubators and artificial brooding is not yet prevalent in Australia Some suggestions concerning these are given later in the chapter

INCUBATION

NATURAL INCUBATION

If breeding geese are allowed to sit and hatch their own goslings this means that many of the large breeds will raise only one clutch for the season They will lay more if the eggs are collected as they are laid—if left to accumulate the goose will stop laying earlier Eggs cannot be held for very long—they should be stored in a cool place and if held over two days turned (right over) daily for up to seven days of age They should weigh 5 to 7 oz according to breed Hatching results will not be good if held any longer than seven days The eggs can be set under hens, Muscovy ducks, or turkeys Some combine incubators with these by setting in an incubator for two weeks then putting under the hens, ducks, or turkeys with good results (Handling methods for an incubator are dealt with later) Four or five eggs can be set under a hen and ten to fifteen under a goose When a goose is used make the nest a wide circle—some hold the nest with stones to form the circle Ducks and turkeys are better than hens for hatching goose eggs Some turn the eggs by hand under a hen, others claim success without this practice Hens should be carefully treated for lice for the long period of incubation Twenty-eight to thirty days for small geese and up to thirty-four or thirty five days for large geese are the incubation periods Goslings hatch out slowly over a period of two or three days The earliest goslings out can be taken away and kept warm until the hatching is completed, but usually the hen or goose is left alone When hens or turkeys are used for incubation the nest should be on the earth and straw, and the

eggs will need daily sprinkling with lukewarm water during the last fourteen days of incubation If a setting goose has access to water for bathing no additional moisture will be needed It is advisable to test the eggs at ten to fourteen days old to remove perished germs and infertile eggs Fertile eggs will show red spider-like lines radiating from the developing germ as with hen eggs

ARTIFICIAL INCUBATION IN FORCED-DRAUGHT MACHINES

Goose eggs should be held as described under natural incubation, that is, daily turning right over with 50°F to 60°F temperature and 60 to 70 per cent humidity in room and the geese should be mature (two years and over) for good hatchability—and receive a breeder ration

Goose eggs do not usually hatch as well as hen eggs in incubators and a hatch of 50 per cent of eggs set would be quite satisfactory Hatchability will fall rapidly with the age of the egg—set up to four days old if possible and not over seven days Goose eggs must be hatched on their own Forced-draught machines can be used, but adjustment to the turning arrangements may be necessary It is essential that the eggs be turned right over, that is one hundred and eighty degrees, whereas incubators for hen eggs usually turn eggs only a quarter turn or ninety degrees The necessity to turn through a half circle means that trays holding goose eggs need wire-mesh covers to prevent eggs falling out Turning three or four times daily is recommended up to twenty-fifth or twenty sixth day The temperature should be $99\frac{1}{2}$°F Test the eggs about the tenth day and at the twenty fifth or twenty-sixth day

The other important essential is that the humidity needs to be much higher than for hen eggs In addition to maintaining moisture trays some operators dip eggs in lukewarm water twice weekly for $\frac{1}{2}$ to 1 minute (as a maximum), others spray the eggs lightly with a garden spray The practice of dipping the eggs daily in lukewarm water for 1 minute during the last week is reported as considerably improving hatching results

The readings required on a wet-bulb thermometer are 89°F to 91°F (65 to 70 per cent humidity) for the first twenty-six days, and then 92°F to 94°F (75 to 80 per cent humidity) for the remainder of the hatch (up to thirty-one days)

It is usually in order not to take off goslings (particularly Embdens) until the morning of the thirty-second day

ARTIFICIAL INCUBATION IN SMALL STILL-AIR INCUBATORS

Goose eggs can be hatched in small still-air incubators, but they require a considerable amount of labour They are operated at a temperature of 102°F for ten days then 103°F for the remainder of the hatch with the bulb of the thermometer just clearing the tops of the eggs, that is, about 2 inches above the tray The eggs are laid on their sides and are turned right over two or three times daily (marking the eggs with a pencil—not indelible type—may assist in this respect) until the twenty fifth day Test at ten days and twenty-five days Humidity must be maintained at a high

level as for the forced draught machines The readings on a wet-bulb thermometer set at the same height as the incubator thermometer, namely 2 inches above the tray floor, should be near 91°F to 93°F (65 to 70 per cent humidity) for twenty-five days and 94°F to 96°F (75 to 80 per cent humidity) for remainder of the hatch This is brought about by spraying daily or dipping the eggs about twice per week for $\frac{1}{2}$ to 1 minute for the first three weeks and daily for up to 1 minute in the last week until chipping Humidity can be kept reasonably well by extra water trays in the incubator Some operators soak a piece of hessian or bagging and place this on top of the eggs daily during the last week The adoption of this practice and/or spraying with a small spray, may be better for many than dipping the eggs in small machines, providing the humidity readings can be maintained When the reading is about 94°F to 96°F (75 to 80 per cent humidity) on a wet bulb thermometer, moisture will usually be noticed on the inside of the glass of the incubator compartment

COMMENT

Reasonable hatching of goose eggs should be obtained if mature geese (correctly fed) are used as breeders, the eggs set are under a week old and held under cool conditions with daily turning two or three times right over during this time This must be coupled with a high percentage of humidity, together with correct temperature and turning during the incubation period

REARING

NATURAL REARING

When a few goslings are being reared with a hen it is advisable to have a small coop and a netted run for ten days to three weeks The run need only be of a temporary nature Goslings need protection from rain for the first month, and should not be allowed out into long, wet grass until they are well covered on the back Water vessels should be deep enough for them to wash their bills but not to get into They should not be left near a pond or a creek for the first three or four weeks The rear portion of the coop should have a board floor covered with litter kept dry to provide dry camping quarters Moving the coop to fresh ground frequently is necessary From one week old they should have this access to greenfeed, preferably cut short A suitable size for the rear portion of the coop would be a floor area of 6 square feet, and a retaining board in front 3 or 4 inches high will keep the litter inside The roof should be waterproof Given favourable weather conditions goslings can roam earlier than two or three weeks—even if the hen be kept confined up to the two-week stage

ARTIFICIAL REARING

The type of brooder shed used for chickens can be used for goslings and the space allowed should be $1\frac{1}{4}$ to $1\frac{1}{2}$ square feet per gosling with a floor brooder to about four weeks Temperatures of 85°F. to 90°F. to start

with as for chickens should be allowed and heat will normally be needed for two or three weeks according to weather conditions Infra red lamps are quite satisfactory with goslings Do not overheat—just sufficieot to keep the goslings comfortable Use a guard as for chickens to train them to the brooder. As soon as possible after a week arrange to have an outside run in which good pasture is available, but protect from vermin such as foxes Also shade must be provided in hot weather (until they are well grown) Restrict the run until they know their way in and out of the brooder house and the approach should be an easy one—goslings need a doorway or "pop hole" without a pronounced ledge After a month they are ready for free-range conditions, if good greenfeed is available Provide a little supplementary feediog from then oo uotil near marketing stage Goslings are normally very hardy, and rearing percentages are good

FEEDING

FEEDING GOSLINGS

Goslings raised on the floor can be fed from the start on high energy chicken battery mash made of crushed grains (fed as dry mixture) of approximately 18 to 19 per cent protein and of fairly coarse texture—or use crumbles of this protein level Also provide ample chaffed greenfeed or have a run made available with young grass Some of the mash could be moistened by mixing with milk and given three or four times daily for a week and two or three times in the second week, but dry feeding of this mash is in order, and pelleted feeds such as crumbles are given dry, and are very satisfactory and save labour Some grains can also be given Shell-grit or sharp sand should be available Waterers should have a guard or grille so that goslings cannot get into the water, which should be deep enough to immerse their bills

Note Should goslings be reared in a battery brooder for the first stage, then the higher protein mash or crumbles (21 to 22 per cent) should be used Crumbles suitable for turkey plus 25 per cent grain are excellent, or use the high-energy griller ration *(See pp 489-92)* After a month the quantity of feed can be gradually reduced when the goslings have ample green range available If being reared inside keep feed of this type available as free choice, changing to feed listed below after six weeks of age

FEEDING AND REARING YOUNG GEESE

After five or six weeks of age, range feeding on grasses can be the major part of the feed, but some 15 to 16 per cent protein all mash or crumbles as for growing stock should be fed Without this extra feed they will not reach good weights, although they may appear big The area of good succulent pasture that should be made available could be one acre for about forty to begin with, reducing to twenty to twenty-five to the acre as they grow, with less than four per acre if very light grazing is required as adults If range dry, then give free choice of the above all mash or crumbles, and ample water (See Appendix 1 for simple concentrate feeding method)

GEESE FOR MARKET

Goslings can be marketed as green geese at from 8 to 12 lb weight at around twelve weeks of age The market usually prefers goslings at this stage, and the best price per pound should be obtained

They are fed as described on p 595 to marketing, but some operators prefer to mix a portion of the feed with milk for the last 3 weeks This improves results, but good returns can be obtained with the dry feeding The rations listed for ducks three weeks to marketing would also be suitable (p 578) They are usually held in small yards for the final three weeks of fattening Holding longer is not advisable Market each batch together if possible to avoid "pining" It is possible to market direct from range

If not marketed at this stage geese are marketed when about seven months old, usually having been on grazing from six weeks up to three weeks before marketing, that is, when about twenty-five weeks old Then feed as above with restricted space

Force feeding as in European countries would not appear necessary here Handle geese carefully to avoid bruising or tearing the skin

SELLING GEESE

Geese in Australia are usually sold direct to the market The Christmas market is normally the best period for the highest prices Prices are not usually as high as for turkeys or cockerels per pound, but the low production cost with adequate range offsets this, making their cost of production the lowest per pound of any form of poultry Loss of weight in dressing is 10 to 15 per cent killing and picking, and 25 to 30 per cent when fully dressed and drawn with head and feet removed, for the purpose of comparing prices for live weight and dressed weight

KILLING AND DRESSING GEESE

Geese should be handled carefully to prevent bruising Starve for twelve hours before killing, but water should be available To kill a goose hang by the feet and cut the jugular vein just below the base of the skull with a 4-inch narrow bladed knife As the goose starts to bleed, loosen the feathers by sticking the knife through the groove in the roof of the mouth and penetrating the rear lobe of the brain at the base of the skull A cup is usually attached to the lower jaw to catch the blood Dry picking produces a nice carcass, but is not as easy as scalding To semi scald immerse the goose in water heated to about 140°F until the feathers pull out freely This usually takes about three minutes If a higher temperature is used do not leave the goose in as long or the skin will scald

BASIS OF COSTS AND RETURNS

Costs are more difficult of assessment with geese than other forms of table poultry, as the quality of the pasture available is a very big factor in the rearing costs The level of supplementary feeding will be determined by this Higher weights than those suggested can be obtained with very

good conditions for the larger breeds An approximate basis for normal conditions is given as follows Variations can be made for local costs

Costs		*Returns*
Approx value of day-old goslings	80c	If average 9 lb live weight for various breeds when marketing at twelve weeks of age with drakelings and goslings then gross return for both sexes could be
Allowance for brooding charges and mortality allowance (not usually very high with goslings)	10c	
Possible feed allowance for early growing stage and some supplementary feed on range 12 lb @ 3c per lb (based on good pasture being available—if dry pasture and more feed needed then returns will be reduced by the value of extra feed consumed)	35c	
Possible costs	$1 25	
Cost per lb live weight = 14c		

Price per lb live weight	*Gross return per 9 lb bird*	*Margin for labour over costs*
18c	$1 58	32c
20c	$1 80	55c
22c	$2 02	78c
25c	$2 25	$1 00

COMMENTS

Possible margin over suggested costs can be adjusted for local variations in feed costs or value of day-old goslings A fairly high value at day-old is reasonable in view of cost of adult birds, long incubation period and hatching percentages usually obtained, and difficulty of supply of eggs for incubation

DISEASES OF GEESE

Geese are very hardy, live for many years and are generally disease-resistant, but they may, like hens, be affected with coccidiosis

Keeping goslings on their own is a good preventive, combined with sanitation Also botulism may be caused through decayed or decomposed matter being eaten Laxatives may help in mild cases

Ticks should be controlled by the usual methods referred to elsewhere, as ticks will cause mortality with geese

Nutritional deficiencies can occur with goslings—feed as with chickens if rearing in dull weather or in confinement

SUMMARY

1 Geese are becoming more popular in Australia and can fit in as a small sideline on general farms Suitable breeds are available—the smaller Chinese breeds are easier to handle

2 Geese can be raised economically owing to greater use of pasture than with other table poultry, but some supplementary feed is needed

3 Geese are very hardy, and do not require range housing They are subject to very few ailments and are long lived

4 Artificial incubation and brooding practice can be carried out successfully, but natural methods are chiefly used with small sideline flocks on farms

5 Geese are used for clearing of weeds in various crops, also orchards, and can fit in well on a farm with very little labour attention For light grazing three or four geese per acre work quite well and at over twenty to twenty-five will eat out the grass

6 The profit margin with geese (as in examples given) will be tied up largely with good breeding stock, ensuring a reasonable production cost of goslings on the farm, and the availability of good pastures or grassed areas to minimize supplementary feeding

ACKNOWLEDGMENTS

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Also reference material from "Raising Geese", by V H Brann, formerly Principal Livestock Officer (Poultry), New South Wales Department of Agriculture, and "Geese" by S Froome, former Chief Poultry Adviser, Western Australia Department of Agriculture

The photographs of the various breeds of geese shown are those of strains bred by J Timperon of Ardrossan, South Australia

CHAPTER 22

DISEASE PROBLEMS

This publication is a general textbook, but some brief disease control recommendations are given to achieve the prevention of as many disease problems as possible. This is an essential part of good husbandry.

A complete and comprehensive publication on diseases is recommended, in which symptoms and effects, and measures for control of the diseases and conditions that affect poultry in Australia are covered. This reference book is *Diseases of Poultry*, by T. G. Hungerford, published in the Australian Agricultural and Livestock Series.

INTRODUCTION TO DISEASE-PREVENTION MEASURES

Some people who have contemplated keeping poultry have considered the idea of running them as too precarious because they have heard tales of flocks being wiped out by disease overnight.

Troubles of this nature have occurred, but in the early days of our industry. Under present-day conditions in Australia, and with the diseases known here, such things do not occur when correct control measures are taken. Australia was fortunate in not experiencing any problem, for a very long time, with fowl plague or Newcastle disease before 1966. (In developing areas vaccination for this MUST be done.)

Owing entirely to the painstaking work carried out by research workers in various countries of the world into the causes of disease, coupled with the advancement in the techniques and knowledge of veterinarians, great advances have been made in disease prevention and control. This has been made freely available to the poultry industry, and one cause after another of mortality and poor growth has been eliminated.

A great debt is owed by our industry to the men who have made this possible by virtue of basic research, and thus enabled the expansion of the industry in Australia. The line of procedure suggested for the poultryman, whether sideline or commercial, is the use of the suggested book on poultry diseases, coupled with reference to practising veterinarians or the State Department of Agriculture.

In the event of any sudden outbreak of trouble with chickens or adult stock involving mortality it is strongly advised that immediate contact be made with the appropriate qualified sources. A prejudice exists with some people in relation to calling on these services for fear of restrictions that may be imposed. This attitude can be the cause of heavy losses on the farm concerned, and on other farms in turn if control measures are not taken. The aim of all qualified operators is to help the poultryman when trouble occurs. This applies to practising veterinarians or State advisory services. The advances in treatment of diseases are not availed of if this attitude is adopted—at all times make an early contact for your own protection.

APPROACH TO DISEASE PREVENTION

Firstly let it be clearly understood that some losses will occur with poultry. The person who claims, on a commercial basis, never to lose chickens or hens, is departing a considerable distance from the truth!

A poultry-farmer who can conscientiously claim to keep pullet rearing losses under 10 per cent to laying stage, combined with under 10 per cent losses during the 12-month laying stage, is very efficient These figures would indicate that the stock had a sound background, that routine preventive measures had been taken, and that general husbandry covering housing and feeding in particular was good.

These figures may be queried as high by some (and as too low by many others), but some wastage occurs at every stage with poultry. All the chickens in fertile eggs do not hatch (over 90 per cent is good) and all chickens cannot be reared except under very good husbandry conditions, without any accidents happening or light culling being necessary.

With adult layers it is reasonable to expect some losses when the production rate of a hen is compared with its body weight A normal-sized layer of 4 to 5 lb body weight fed efficiently and of reasonable breeding background, laying 200 good-sized eggs for the year is producing 25 lb. of eggs or five or six times its body weight in food in a year. At 300-egg production level the weight of eggs is approaching 40 lb, or eight or nine times the weight of the bird This is under 3 lb. of feed consumed for every pound of edible food produced, which represents very high food-production efficiency Some wastage and "stress" must occur in the process of conversion, particularly as it is not normally practicable to give birds sterile conditions of constant temperature level Every departure from ideal conditions for stock in relation to housing, feeding rations, and recognized husbandry practices causes extra strain on the birds. The factor of the size of flock has a marked bearing on this question—the greater the number of birds together the greater the chance of breakdowns causing mortality. These factors should be considered, and comparison can be made with the results of Random Sample Tests The best of conditions are available to entries in these tests. They are usually in small numbers but adult mortality rates of 3 to 5 per cent are the lowest obtained, and up to 18 per cent and more in other cases in various States.

A figure of under 10 per cent can therefore be regarded as representing high efficiency as an average for various breeds

SOURCE OF STOCK NOT SOLE CAUSE OF MORTALITY OR POOR GROWTH

It has been often noted in extension work that there is far too great a tendency among those raising young stock to "blame the breeder or hatchery" for everything that goes wrong with young stock being reared. There are of course cases where the stock is at fault, but in general, where chickens obtained or delivered have been well hatched and look bright (and are from blood tested stock) and are then given good husbandry conditions, they should rear satisfactorily.

Random sample tests in the various States of Australia have shown excellent rearing results are possible with stock from a variety of sources when given good conditions (In the 1964-5 Random Sample Test, Victorian entries were reared with a loss of only 1 6 per cent to 17 weeks, and in the 1961-3 Random Sample Test in South Australia the entries were reared intensively with only 23 per cent loss 6 weeks to 21 weeks of age)

Many cases have been observed where stock from a good source has appeared to be from entirely different strains, simply because of neglect and bad conditions Some had condemned the stock—instead of their indifferent husbandry In other cases excellent rearing results had been obtained owing to the good husbandry methods adopted

The main causes of most of the disease troubles in rearing stock are indifferent and incorrect feeding, poor houses, overcrowded and ill-ventilated, and a general lack of attention to general routine, including attention to water and feed supplies, and vermin control

Far too often chickens are left until near laying stage in a shed that is just big enough for them at six weeks, and this predisposes to disease, apart from an automatic retarding of growth and large numbers of culls

The feeding ration is usually close to the mark when purchased ready mixed or prepared according to some satisfactory mash formula but then grain is often fed with this at too high a level, upsetting the protein required in the feed Then again the lack of green on overcrowded range areas is too often seen These faults bring about conditions that reduce the vitality of the stock so that they readily contract various complaints

Coccidiosis, blackhead, vitamin A deficiency, riboflavin deficiency, or worm infestation, may then crop up to a greater or lesser extent Unfortunately, although the person rearing the stock realizes that the pullets or cockerels do not look bright or even in growth, and some birds are dying off, in far too many cases the source of stock is blamed, and it is left at that A change of stock next year or something of that nature is considered, or the feed purchased is blamed as 'no good'. It is most important when young stock are not doing well, that a check be made in order to find out the trouble Ask questions like the following

Do rations comply with those described for the particular stage? Is there sufficient feeding room?

Is there sufficient room in the sheds according to the age of the stock?

Is greenfeed (in wet or dry form) available in sufficient quantities?

Is water adequate and clean?

Is the range or the intensive rearing shed overcrowded?

Are there any parasites on the birds or in the sheds?

If these can be answered satisfactorily, then immediately seek qualified advice as to the disease condition troubling the stock

SOME CAUSES OF LOSSES IN RAISING YOUNG STOCK—AND HOW TO PREVENT THEM

BEFORE SETTING THE EGGS IN THE INCUBATOR

1 Use healthy breeding stock that have been blood tested in order to remove any hens affected with pullorum disease

2 Feed the breeding hens on the correct rations shown in Chapter 14. These are correctly balanced so that it is possible to hatch a satisfactory number of chickens that will not be handicapped, and to prevent rearing loss due to deficiencies brought about by a lack of vitamins and elements in the feed of the breeding hens, as the chickens in early stages are dependent on this

DURING THE INCUBATION OF THE EGGS

1 Correct incubation practice as set out in Chapter 9 must be carried out to hatch strong chickens that can be reared easily. Poorly hatched chickens, due to violent temperature fluctuations, incorrect moisture levels and ventilation, or a wide departure from the maker's instructions, cannot be reared in satisfactory numbers by the most skilled operators, and they never do as well as they should

2 Maintain a sanitary condition in the machine as set out in Chapter 9, to enable the chickens to start life without the handicap of hatching in dirty surroundings

DURING THE BROODING PERIOD AND REARING PERIOD

Some of the common disease conditions that affect young chickens and can be prevented by correct husbandry are as follows:

(*Note* For other disease conditions of a contagious and infectious nature that affect chickens, but are from causes outside of control by good husbandry and preventive veterinary practice, the reader is referred to *Diseases of Poultry*, by T. G Hungerford, where these are dealt with in detail)

TABLE 25

SYMPTOMS AND TREATMENT OF DISEASES IN YOUNG STOCK

Disease	*Symptoms*	*Control*
Pullorum disease	Heavy losses (20 to 90 per cent) usually from 3 or 4 days up to 3 weeks Heavy breeds worst affected Chickens paste up, uneven development, huddle together, chirp or whistle in pain	Prevented only by blood testing of breeding stock that produced eggs from which chickens are hatched Disinfection of brooders also necessary. If breeding on farm, have all stock regularly blood tested and comply with all conditions Further reference to pullorum disease later.
Chilling	Sudden losses Chicks huddled together and damp—usually found packed up dead in morning	Raise brooder temperature Ensure chickens can get back to warmth in night. Temperature high enough in evening, to be maintained in early morning Avoid ground draughts. Improve brooder house.

TABLE 25—*Continued*

SYMPTOMS AND TREATMENT OF DISEASES IN YOUNG STOCK

Disease	*Symptoms*	*Control*
Starved chickens	Do not grow—losses about 3 to 5 days. Crops empty Losses may be heavy particularly if feed not given within 48-60 hrs, of hatching.	Increase feeding space Feeders and waterers to be near warm portion of brooder Provide a light in the room to shine on the feed and water to attract chickens, keep sufficient water and feed containers inside or alongside the warm portion of the brooder. Have feeders accessible.
Coccidiosis	Usually sudden outbreaks Chickens huddle. Usually blood-stained droppings Losses can be heavy—usually from 3 weeks to 10 or 12 weeks, but in chronic cases may affect young stock up to several months of age. Blood-stained droppings not seen in these cases, (Coccidiostats usually used with broilers.)	Give right feed and sufficient room in shed Maintain a dry condition at all times, particularly around waterers Use fresh ground for chickens reared on range or fresh litter for each lot reared intensively. Avoid overcrowding and insufficient ventilation Give adequate warmth to chickens in the warm brooding stage Do not overuse drugs as a safeguard. Milk powders are a valuable ingredient in chicken mashes to aid in preventing coccidiosis. (When outbreaks occur increasing the level up to 40 per cent for a period is very helpful as a control) Various drugs are used for efficient results when outbreaks occur in spite of good conditions, for example, with prolonged wet weather or rapid weather changes. Take steps to treat quickly to avoid heavy mortality. It is sound practice to combine the use of the recommended drug and the addition of a high level of milk powder for best results with treatment
Enterohepatitis or blackhead	Comb may be faintly bluish. Birds mopey and die quickly. Pullets poor in condition often found with this trouble Droppings yellowish or blood-stained. Usual occurrence during reaction to fowl-pox vaccination Some may linger in poor condition for a long period	Maintain correct hygiene—avoid overcrowding, dry conditions should be maintained. Isolate young birds when rearing. Carry out a careful deworming routine before vaccination for fowl-pox, individual handling or treatment through feed and/or water can be used. *Note* This trouble is more prevalent in many flocks in chronic type than some farmers realize. Poor growth and gradual loss of birds occur through failure to recognize the condition

TABLE 25—*Continued*

SYMPTOMS AND TREATMENT OF DISEASES IN YOUNG STOCK

Disease	*Symptoms*	*Control*
Rickets	Leg weakness and paralysis. Bones can be bent instead of snapping. Chickens two to three weeks old or more. Deformed legs—unsteady gait—"rubbery" beaks—high mortality.	Where chickens are without direct access to sunlight or have a limited amount of sunlight rickets can occur. It can usually be prevented by adding sufficient cod-liver oil or oil emulsion or powders containing vitamin D_3. Balanced rations will prevent troubles of this nature. Maintain the oil emulsion or powder levels suggested in Chapter 14 for chickens and adults. (See pp 343-7.)
Vitamin A deficiency or "nutritional roup"	Pimples in throat and mouth. White discharge in eye. Leg weakness. Mortality can be heavy. Loss of egg production.	Prevent by providing greenfeed in sufficient quantities. If greenfeed of poor quality, or only in limited amounts, feed vitaminized oil emulsion or vitamin A in powder form in addition. Provision of sufficient greenfeed in wet or dry form plus added vitamin A is stressed as a preventive. (Refer Chapter 15 on Greenfeed for further information.)
Vitamin E deficiency	Dull condition with lack of control of movement and weaving of head. Loss of use of legs. (Crazy chick disease is another name for this complaint.)	Rations incorporating good-quality crushed grains, or bran and pollard containing the wheat germ, are normally satisfactory combined with correct levels of oils in the ration. If an excessive amount of cod-liver or fish oil is used, oxidation may upset the utilization of vitamin E. Stale feeds may have a low level. Wheat-germ, peanut oil, cotton-seed oil are rich in vitamin E and these, or synthetic vitamin E can be added to feed if this trouble occurs. (Wheat soaked

TABLE 25—*Continued*

SYMPTOMS AND TREATMENT OF DISEASES IN YOUNG STOCK

Disease	*Symptoms*	*Control*
Mycosis	Birds dark in comb, which is also shrivelled Die rapidly Diarrhoea	Do not allow access by birds to any mouldy material such as litter haystacks, mouldy grape skins (residue from wine distilleries) mouldy wheat Prevention of access to mouldy materials only cure

(For Riboflavin (Vitamin B_2) deficiency effects and needs see pp 349 51)

MAJOR PROBLEMS WITH YOUNG STOCK

These apply particularly to those commencing with poultry—in Australia or developing areas—or those running sideline units

PULLORUM DISEASE

The most drastic complaint with chickens from day-old to three weeks of age, pullorum disease was responsible for heavy losses during the first three-week period of rearing chickens with many aspiring poultry keepers throughout Australia in the early days of our industry The high mortality rates experienced by many, particularly with heavy breeds (up to 80 or 90 per cent lost) were attributed to fumes in brooders and incubators or poor brooding techniques Many farmers could not hatch fast enough to maintain a constant number of chickens, in spite of good husbandry skill in rearing This complaint cannot be cured by good husbandry—if some *of the breeding hens have pullorum disease, then it is passed through the* egg to the chicken—and it is too late to do much about it The financial losses in these cases are crippling The production of large numbers of chickens in agitated air machines (as compared with still air machines) spread the disease more rapidly as commercial production increased

Research work eventually proved pullorum disease to be the cause of these mortalities It was also shown that if the hens that carried the disease could be located by "blood testing" and eliminated from the flock, this would prevent the spread of pullorum disease This work can be carried out in the field and birds detected in a matter of minutes, thus making large-scale operation possible

This represented one of the greatest advances in preventive husbandry made available to the poultry industry The economic gain is difficult to assess, but a reference to Chapter 7 will show that the direct loss of pullets, plus indirect production loss from these pullets, if a 40 per cent mortality occurred, would be in the vicinity of £500 per year per 1000 layers on a unit Blood testing for pullorum has saved this in many cases It is essential in preventive husbandry and great progress has been made in the industry in this respect It has become an established practice whether carried out by State Departments of Agriculture or private practising veterinarians

To cite an example on a large scale a voluntary blood testing programme

was started in South Australia with 13,000 fowls in 1946, and it was shown that 25 per cent of the birds were carrying the disease. By 1956 over 100,000 birds were being blood tested and the incidence of birds carrying the disease was under 4 per cent. Numerous individual farms that complied in all respects with the requirements of testing for an accredited farm, reached figures of under 1 per cent reactors. This excellent result indicates that the industry will co-operate in efficient practices and movements that are shown to be for its betterment as an economic proposition.

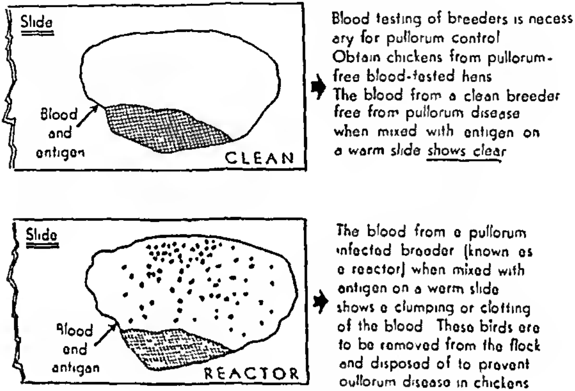


Fig. 194 Basis of pullorum disease control.

This programme was under the control of H. V. Chamberlain, formerly Senior Veterinary Officer, South Australian Department of Agriculture, who described the techniques used, and gave general information on pullorum disease, in Bulletin 400, "Pullorum Disease and its Control", South Australian Department of Agriculture.

Other States have achieved control of this disease, and for detailed information on the general techniques employed by veterinarians, the pitfalls involved, and other relevant information on pullorum disease, the reader is referred to *Diseases of Poultry*, by T. G. Hungerford.

It can be responsible for very heavy losses in chickens Acute cases are usually identifiable by a huddled up appearance, blood-stained droppings, and heavy losses Chronic cases linger in poor condition for months, and are below size and if not treated will be a complete loss on a farm

The emphasis must be placed on prevention by good husbandry and not reliance on drugs * We have the advantage today of proven drugs to combat outbreaks, but this must not be relied on to the exclusion of giving good conditions

The disease may be cured, but not the retarded growth and the lowered resistance to other diseases later Pullets that have experienced a heavy bout of coccidiosis are never as good as they otherwise would have been —some authorities consider they should be "written off" The golden rule therefore is prevention by feeding rations as recommended in Chapter 14, plus good range conditions with fresh ground and good rearing sheds, or dry, well ventilated, intensive deep litter rearing conditions Chickens from battery brooders, and to be later reared on the ground, will be "soft" and non resistant, if held too long in these wire floored brooders (Laying cage birds can be reared through all stages on wire) When outbreaks do occur treatment must be started quickly As mentioned previously drugs should be used as directed Also the value of milk products in the feed is stressed The drugs that have been given to the industry as the result of research are not something to be leaned upon and good husbandry ignored, or the object becomes defeated

For information on coccidiosis—causes, species, history, symptoms, and control methods—refer to *Diseases of Poultry* by T G Hungerford

ROUND WORMS IN YOUNG STOCK

This trouble commonly crops up from about eight to fourteen weeks The occurrence of round worm infestation is of great economic importance It should be regarded as routine treatment to deal with the prevention of worm infestation in young stock as a general "insurance policy If young stock are run on stale ground or in contact with old stock, then it is almost certain that they will be infected to a greater or lesser degree

When they are given good conditions with correct feeding and reared in isolation on suitable well drained ground that is kept exclusively for the rearing of chickens, there is a very reasonable chance that the young stock will be clear of worms

Clean fresh surroundings (and dry litter and particularly dry conditions around waterers) coupled with good growing rations (see Chapter 14) are safeguards in building resistance against worm infestation

The presence of round worms in large numbers causing poor growth and a subsequent loss of production can mean a heavy loss on a farm Failure to safeguard the growing stock means that it may be necessary to treat the birds when laying, or that the commencement of laying is considerably delayed by worms An anticipated production of 50 per cent

* The use of a coccidiostat at constant level in feed for raising broilers is accepted practice and gives a very high level of control for coccidiosis when combined with good rearing conditions These broilers or grillers are marketed at 10 or 12 weeks of age

from pullets could, owing to worms, be reduced for the winter period to 30 per cent This would mean, with an example of eggs at 40c average per dozen net for this high-price period, 80c per pullet (2 dozen eggs) lost or $800 with 1000 pullets

Symptoms Loss of condition, lack of lustre in feathers, possible paralysis, diarrhoea may be yellowish, fluid, and frothy and sometimes blood tinged Pale legs and a general huddled up appearance Worms will be found in the intestines of birds examined

Method of treatment A recommended treatment for round worms is by individual dosage Carbon tetrachloride is administered at rates from 1 c c up to 4 c c according to age—1 c c at 6 or 7 weeks, 2 c c at 10 or 11 weeks, 2 or $2\frac{1}{2}$ c c at 11 to 14 weeks, 3 c c at 14 to 17 weeks, and 4 c c over 17 weeks

One individual dosing is normally regarded as sufficient—it is administered by means of a drenching gun The technique requires care in the use of the gun to prevent spilling any liquid in the windpipe, also correct holding of the bird so that it does not struggle The process requires considerable practice, and if the farmer does not have the work carried out by a qualified person, he is advised to have a demonstration of its use before drenching the flock Birds normally exhibit a considerable degree of resistance to re infection (Worm capsules from reliable sources are satisfactory for individual treatment Use as per maker's directions)

In heavy infestation another treatment in a few weeks may be necessary, but in general the practice of following up with a flock treatment using nicotine sulphate or phenothiazene in the mash is sufficient a few weeks later Two or more flock treatments may be advisable, but one usually suffices (Some use the phenothiazene treatment method only)

Treatment for caecal or small round worm (and its relation to blackhead) Control of the small round worm is brought about by the use of a mash (as mentioned above) containing a dosage of phenothiazene Proprietary lines are available containing both nicotine sulphate and phenothiazene These will serve as a control for both large and small round worm The small round worm or caecal worm is strongly suspect in relation to blackhead It is recommended practice to treat birds before vaccination to reduce the risk of mortality from blackhead at the time of the systemic reaction from fowl pox vaccination The presence of blackhead should be checked for, if pullets appear in poor condition Some farmers rely on this mash treatment only for all worms and it appears reasonably successful Efficient products are also available for use in the water For complete information on round worms (and the other types of worms that affect poultry) and the techniques of treatment the reader is referred to *Diseases of Poultry*, by T G Hungerford

COLDS '

Often experienced with pullets around fifteen to twenty four weeks, the respiratory problem which has been referred to as the common cold in poultry is a source of great economic losses It usually occurs around the late summer and autumn period This means that young pullets become

affected just as commencing or about to commence laying (Old birds are more resistant—or are settled in their conditions)

Outbreaks often occur when pullets are moved into their laying sheds from rearing quarters—particularly if they sleep at night on the litter

The mortality experienced is not great—in many cases this does not occur, but the economic loss is terrific Pullets affected as the colds travel through the flock may only average 20 to 25 per cent production over the winter period This could, on the basis of the example given earlier for round worms, mean a loss above the amount quoted in that case, which means from each 1000 pullets with eggs at 40c per dozen a reduction in returns of about $1200 over the winter period!

This could mean a very serious financial position, as such a reduction could not be made up later, and a marked loss on operations for the year

Many farmers, owing to their excellent husbandry, have never experienced this type of trouble at all The standard of husbandry is all-important in controlling this trouble Keeping layers in small flocks is a sound precaution Sheds with ample ventilation, such as the Dryden type reduce these respiratory problems Vaccination cannot be carried out, neither does an immunity develop

Symptoms Coughing and sneezing with "bubbles or running" of tears from the nostrils and the eyes Dust will be seen adhering to the nostrils The birds will wipe their eyes (which often become swollen) on their feathers, thus showing wet patches on the feathers The birds look very miserable and colds or coryza can very easily be confused with other complaints under the vague general heading of roup (being nutritional roup, fowl-pox, infectious laryngo-tracheitis, etc), and in some cases it is combined with some of these In general the main difference with colds as compared with the others mentioned is that canker is not present *Obtain qualified advice when these respiratory conditions are evident*

Control The control for "colds" (and for reduced severity of outbreaks of the other conditions mentioned above) is strict attention to husbandry by providing the right conditions as listed earlier in the book for rearing of young stock, and housing and feeding of layers

Very briefly these are Avoidance of overcrowding Overcrowding is one of the main causes, and pullets, particularly if late hatched, are almost certain to have colds if overcrowded either in the sheds or with too small a space on and between the roosts (Birds roosting in trees with ample room and free from draughts very seldom get colds but egg production usually suffers) Worm infestation lowers resistance to colds Lack of sufficient greenfeed (in wet or dry form) is one of the main causes of respiratory troubles (nutritional roup—dealt with under Greenfeed earlier —is directly due to this lack of vitamin A), by lowering resistance Dusty, humid, and poorly ventilated quarters are a major cause (Sheds without ventilation at the back and nearly fully closed up in the front are "death traps" *Dry pens and litter, plus ample ventilation, are essential*)

Treatment Rectify the above omissions Try to promote feeding—molasses in the feed is helpful Use correct rearing, feeding and housing methods

C R D (Chronic Respiratory Disease) may often be confused with, or combined with, these problems The severity of the trouble will be affected by the housing efficiency, particularly ventilation used, and the general husbandry standard Qualified veterinary advice should be sought for control methods

Combination of control Methods for control of C R D (chronic respiratory disease) by testing flocks, in combination with routine pullorum testing, and its practicability, were discussed in a paper presented at 1964 Poultry Convention, Queensland by J. H. Bray, S A. Dept. Agric.

For complete information on the various types of diseases of a respiratory nature the reader is referred to *Diseases of Poultry* by T G. Hungerford

STOCK PROBLEMS CONTROLLED BY VACCINATION

The practice of preventing diseases by making all possible use of advances in disease control is a basic part of good husbandry practice Some reference is given here to this and where any of these troubles occur in the district, or have been experienced on the farm, it is recommended that appropriate steps be taken to carry out the necessary vaccination

VACCINATION FOR FOWL-POX (AND RISK OF BLACKHEAD)

The first requirement for fowl-pox vaccination is that the pullets should be in good health, free of any signs of colds, and clear of worms, particularly the small round worm This means that deworming must be carried out before vaccination for fowl-pox, otherwise the systemic reaction that occurs from two to three weeks later can be very severe Instead of the birds just looking a little dull and mopey at this time, an outbreak of blackhead may occur, with the birds looking sick, droppings yellowish or blood stained, pale combs and legs, and a leaden or bluish colour of the face and heavy mortality can occur (up to 50 per cent) or lingering deaths for a period may result (The treatment suggested for blackhead is the use of drugs as directed by veterinarians or the manufacturers)

PREDISPOSING CAUSES OF FOWL-POX

The causes that may render birds more likely to contract fowl-pox are as listed for colds, namely deficiencies in relation to feeding, insufficient room in housing, bad ventilation, worm infestation—in effect any neglect of good husbandry methods

The disease is more likely to occur in late summer and autumn Mosquitoes should also be controlled as much as possible, as they spread the disease from affected birds to healthy birds

ECONOMIC IMPORTANCE OF FOWL-POX

As with colds young pullets are frequently affected and the loss in growth and almost complete breakdown in laying for a period of two or more months coupled with mortality means that an even heavier loss than with colds occurs It would be possible that with each 1000 pullets and a

loss of up to 4 dozen eggs per bird over the winter period (with eggs at, for example, 40c. net) would mean up to $1600 lost! The additional danger is that even when fowl-pox has run its course other troubles may be "triggered off" owing to the lowered condition of the birds.

TREATMENT FOR AFFECTED BIRDS

Treatment is of little help as the disease runs its course, and then the bird is immune from further attacks (of that particular type of fowl-pox). Painting the scabs with iodine or some astringent may hasten the drying up of the scabs. The only safe method of treatment is prevention by vaccination, although if an outbreak occurs, the use of pigeon pox vaccine will be helpful with adult stock.

AGE FOR VACCINATION

The usual age is suggested as about twelve weeks. Pullets left much later than this suffer a heavier reaction and if left till eighteen or twenty weeks they may be starting to lay in some cases and reaction can be prolonged and heavy. The age of twelve weeks also allows worming to be carried out first because, as mentioned before, young stock (pullets or cockerels) should be clear of worms and free of colds.

VACCINATING

This is usually done by the stab method. A large darning needle broken off at the eye leaving two points about $\frac{1}{8}$ inch long is used or a "stabber" is purchased. This is placed in a needle holder. This is dipped in the prepared vaccine and the fold of skin between the left leg and body is jabbed—usually twice. It is advisable that the farmer obtain some instruction from a qualified operator, or that he employ a qualified operator or veterinarian.

In conclusion it is considered that in most areas where fowl-pox occurs a farmer should vaccinate (check veterinary advice), as the cost is slight, but the losses in production from the fowl-pox can be high. It should be regarded as a rule of good husbandry. Vaccination for fowl-pox appears to have a helpful tendency against respiratory troubles in general. Also it must be stressed that because fowl-pox can be controlled by vaccination the husbandry factors should not be neglected. Unthrifty stock will occur, because of incorrect feeding and overcrowding, even though they have been safeguarded against fowl-pox.

For complete information on fowl-pox vaccination, vaccinating technique, alternative ages for vaccination, and preparation of vaccines the reader is referred to *Diseases of Poultry* by T. G. Hungerford.

INFECTIOUS LARYNGO-TRACHEITIS: VACCINATION TREATMENT

The same husbandry factors referred to for other respiratory diseases apply inasmuch as that resistance factors should be kept as high as possible. Losses can be very high—up to 80 per cent of a flock—although usually up to 35 per cent. In any area or farm where this trouble has

occurred vaccination is usually carried out This vaccination is usually carried out prior to that for fowl-pox Vaccination for *I L T* calls for more skill and knowledge on the part of the veterinarian than any other in poultry-disease control This is a very serious disease of an infectious nature and it is not considered within the scope of a husbandry publication It is strongly advised that if any poultryman sees any cases of birds on the farm with the following symptoms he make immediate contact with a practising veterinarian specializing in poultry diseases or the State Department of Agriculture for directions

Birds have a frothy discharge from the beak, make gurgling noises, and give moist coughs, flinging the head into the air, also cough up blood or have it visible in the windpipe Other birds may die after a convulsion This disease calls for quick action as advised above A complete description of the disease and control methods by vaccination and all relevant information is given in *Diseases of Poultry* by T G Hungerford

MOSQUITOES

Mosquitoes should be controlled as much as possible by covering stagnant water and tanks with kerosene They should be attacked particularly when fowl-pox is likely. Mosquitoes also spread, in addition to fowl-pox, tick fever and possibly other diseases In addition they disturb the birds' rest, hence both from the viewpoint of the poultry and those persons living on the farm, precautions should be taken

CONTROLLING EXTERNAL PARASITES

FOWL TICK FEVER (Spirochaetosis). VACCINATION TREATMENT

Fowl tick fever is responsible for very heavy losses with poultry, particularly in the drier, low-rainfall areas of Australia In some districts the numbers of tick are so high that in spite of a constant spraying programme heavy losses still occur Where stock are hatched on the farm from birds that have survived tick fever outbreaks they transfer immunity to the chickens for a period of some weeks If they are bitten during this period the immunity continues for a longer period and they live successfully in these areas When new stock are brought in they will die in large numbers unless vaccinated (when complete eradication of the tick is not possible)

This trouble is experienced mainly in the hot weather. The economic loss can be very great with tick fever, particularly if pullets are nearly at the laying stage. It can be more than comparable with the figures quoted for the other diseases, as mortality rates of up to 80 per cent may occur when the trouble is experienced in acute form In mild form birds frequently recover and are then immune to further outbreaks

Symptoms of tick fever In the acute form birds are mopey and huddle about They usually have a greenish diarrhoea and are very thirsty. partial paralysis may occur. Death may occur in one to three days In the mild form the trouble does not progress to the complete paralysis

stage and the diarrhoea may be whitish A high body temperature is a characteristic, also a yellowish appearance of the comb in the early stages Laboratory diagnosis may be necessary to prevent confusion with other diseases (unless tick are found present gorged with blood, which can usually be regarded as fairly conclusive evidence that the complaint is tick fever)

How tick fever is spread Ticks live on birds as larvae for five to ten days (size of about a pin's head at this stage) then return to the timbers of the shed After passing through a period of moulting they emerge as adult ticks (Leaden coloured, oval in shape, and about $\frac{1}{4}$ inch long at this stage) They then bite the birds, infecting them with tick fever The process is faster in hot weather Red mite acts as carriers, though not blamed for starting tick fever, but cases have occurred of tick fever on farms with no tick found—although possibly present—and heavy numbers of mites in the sheds

Mosquitoes can spread tick fever, also lice New sheds are not a safeguard, *as ticks will travel a considerable distance to a shed*

How to find the ticks. Search carefully in cracks and crevices, under roosts, and in roof timbers The presence of ticks in a crack will be shown by black circular spots like large "fly spots" These can be termed the droppings of the ticks Look under loose bark, bags, or in old crates A knife inserted in a crack that cannot be opened up will usually show blood stains on the blade if ticks are present Ticks can live for years in a shed without poultry They will also live under the bark of trees Roosts set apart from the wall of the shed make control much easier, as the ticks cannot easily reach the roost—and the birds at the end of the roost cannot be used as a "bridge" by the tick, as would be the case if they were too close to the wall

How to eradicate the ticks A thorough spraying programme is necessary This must be carried out very thoroughly with a pressure spray (a knapsack or bucket spray can be used) An old shed of native timber and a thatched roof should be burnt—it will be almost impossible to kill all the ticks The spraying must be carried out at intervals of five or six days at least three times to break the sequence of hatching Thorough sprayings at wide intervals are of little use DDT spray with kerosene, and Gammaxane, are very effective as sprays Sheep dip can be used Kerosene emulsion is also effective and cheap Kerosene emulsion is made by taking 1 gallon boiling water and cutting up $\frac{1}{2}$ to 1 lb of soft soap, mixing well, then adding 1 gallon of kerosene, keeping it well stirred until it is a creamy emulsion Then add 4 gallons of water, keeping it well stirred while mixing and using Also paint the roosts with these sprays, or use kerosene and oil (such as sump oil) two parts kerosene to one part oil or 50-50 will suffice, or suitable oil residues from gas coal, but the DDT preparations give a more lasting effect

Vaccination for ticks Poultry can be easily and effectively vaccinated against ticks This has been a great boon in heavily infested areas, and the industry owes a further debt to research work on this question L Hart,

formerly of Glenfield Research Station, New South Wales, prepared and patented a vaccine for tick fever control This vaccine costs about 3c per bird and 1 cubic centimetre is injected with a syringe into the muscle of the upper fleshy part of the leg (or into the breast of the bird) If pullets or cockerels are injected after twelve weeks of age the immunity will last A solid immunity develops after about three days For practical purposes it will last the life of the bird Birds affected with the disease and then injected have in some cases recovered, but vaccination before any outbreak is the rule If an outbreak occurs all the remaining birds should be vaccinated at once to check the spread of the disease

Note It is important that vaccination should not be relied upon as the only measure Spraying to eradicate ticks as much as possible must be carried out or health and egg production will be reduced The ticks will operate on the same lines as red mites and owing to their blood sucking activities the vigour and health of the birds will be reduced and their resistance to other complaints lowered Vaccination, as in other cases, is a valuable aid, but does not reduce the necessity for good husbandry

Note In developing areas outside Australia, it will be a vital need to vaccinate against Newcastle or Raniket See veterinary officers

CONTROL OF EXTERNAL PARASITES OTHER THAN TICKS

There are a number of external parasites that worry poultry and will cause heavy economic losses in many instances, particularly with red mites if not controlled by spraying

RED MITES AND THEIR ECONOMIC IMPORTANCE

These are found on many poultry plants throughout Australia, and they are a cause of great loss on farms With their incessant blood-sucking activities they reduce the health of the birds, causing heavy loss in egg production and a lowered resistance to disease conditions They can also transmit tick fever They breed in tremendous numbers, during warm weather in particular, but also multiply rapidly in the winter if unchecked They must be eliminated if possible to obtain full returns from the birds Cases have occurred of an anticipated 50 per cent production being reduced to 10 per cent through their presence in heavy numbers

Where to find them They will be found under the roosts where they rest on the bearers They are about the size of the head of a pin, and red in colour when gorged with blood They usually come out at night for their blood-sucking activities and then return to their hiding place Greyish markings along cracks are a sign of their presence They will follow the fowls. If the fowls roost on top of the nest boxes then mites will usually be found there (look under dry manure—this is a favourite spot for them) In any shed where they are left unchecked the litter can also become full of mites and eradication is difficult As with ticks, arrange to have the roosts not closer than 10 inches at any point to a wall of the shed, and roosts should be carried on bearers on separate stands or posts If the mites are kept in check at the roosts they will not multiply sufficiently to infest the

rest of the shed and the litter Steel construction is a safeguard, but not completely effective Laying batteries can become infested with mites Any joint in the steel can be a harbour, and also under any manure accumulation (They can be a major problem where birds sleep on the litter)

Control of mites Spraying with DDT sprays as recommended above for ticks, or painting the roosts with these preparations, and/or kerosene with oil such as sump oil Kerosene emulsion can be used, also suitable oil residues from gas coal—in effect deal with as for ticks Some DDT preparations have given a complete "kill" in a shed, this lasting for an indefinite period Controlling mites is a big factor in efficiency

EXTERNAL PARASITES USUALLY FOUND ON BIRDS

Fleas

Fleas can be a source of considerable loss and worry on a farm They will suck blood and seriously disturb the rest of poultry They can, if in sufficient numbers, render attention to the poultry almost impossible

Control measures Eradication of fleas may be very difficult with sandy floors in sheds Control is very much easier if concrete or impervious floors are used The availability of DDT sprays and Gammaxane have made it possible to eliminate fleas and a very complete spraying programme must be carried out weekly until the fleas are exterminated The shed, floor, and adjacent yard (and litter—which should be burnt) must be thoroughly sprayed

Stickfast Flea

The characteristic of this type of flea found in many of the sandy and coastal areas of Australia is that it attaches itself to the bird (hence the name stickfast) mainly around the comb, wattles, and eyes They cause intense irritation to the birds and will rapidly kill chickens A close examination should be made, as the appearance might lead some people to think that the birds merely had some blood on the comb due to fighting or picking

The stickfast flea can be introduced by domestic pets and flying birds The same careful spraying programme as mentioned for fleas must be carried out, with the additional requirement of painting the heads, wattles, and combs of badly affected birds with neatsfoot or kerosene 1 part, lard 3 parts, or DDT emulsion Contact with a veterinarian is advisable

Poultry Lice

Lice of various types can live on birds at all times They multiply very rapidly and cause poor health by irritation, loss of sleep and blood, resulting in poor laying and reduced fertility Male birds are particularly likely to be infested, as they do not dust bath as often as hens do Lice can be seen moving through the feathers of birds (particularly near the vent) if these are parted quickly before they run out of sight

Control measures Birds usually control lice by means of dust bathing If a patch of ground is sprinkled, particularly in warm weather, birds will

avail themselves of it very quickly They will also use deep litter for the purpose The action of their throwing sand or litter through the feathers removes lice "Off colour" birds that do not dust bath can become very infested until eventually they become paralysed

Dusting Individual birds (particularly male birds at the start of a breed ing season for the sake of good fertility) can be kept free of lice by dusting with DDT powders or various proprietary powders Also sodium fluoride neat or one part to three parts flour can be used These should be worked carefully through the feathers, particularly below the vent Any eggs at the base of the feathers should be saturated with a non-irritating oil such as olive oil Feathers can be snipped off and burnt if just by the vent—particularly in the case of male birds, as it improves fertility to clear these feathers Repeat dusting in a week to ten days If desired to dip birds (on the morning of a warm day) a suitable mixture is 4 oz sodium fluoride to 4 gallons water Immerse birds twenty to thirty seconds only—duck the head once or twice

Fumigation When large numbers of birds are to be handled it is not practicable to hand dust birds individually from the viewpoint of labour efficiency A group treatment that is effective is to use nicotine sulphate (blackleaf 40) Select a still night and spread a thin line only (about pencil-line thickness) on top of the roosts just before the birds go to roost The warmth of the birds' bodies causes vaporization and the rising of fumes This should be repeated in 10 days Another product is benzene hexachloride and this can be used as a perch paint—available from proprietary sources This is painted on the roosts and is very effective It acts in a similar manner to nicotine sulphate, but it has a marked residual effect and does not need a repeat treatment It will also control head lice to a greater extent than nicotine sulphate

These measures will completely control most types of lice that infest poultry except head lice These may not be all killed by fumes from perch treatment They should be watched closely with young stock, as they can cause paralysis and poor growth Smear the affected parts with olive oil or neatsfoot oil or lard and kerosene (Mixture 2 pounds lard to 1 pint kerosene)

Note Be careful when handling dusts and sprays used for lice, mites, or ticks to wash the hands carefully and use old clothes Also avoid contamination of feed troughs and water troughs, as most of these insecticides are poisonous Watch for lice and mites transferring to oneself —they can cause considerable irritation

Depluming Mite

This mite invades the skin at the base of the feathers This causes the bird to pick at the irritated part, causing bare patches These areas are usually reddish in colour somewhat resembling ' sunburn"

Control This is difficult, but DDT solutions can be effectively used Other treatments are 20 per cent kerosene emulsion, sodium fluoride one part, flour four parts or sulphur ointment 20 per cent These can be rubbed into the affected portion Treatments will need repeating

Scaly Leg Mite

This is an annoying and unsightly condition It is spread by contact It will spread from an affected hen to chickens Heavy breeds are affected more than light breeds Older birds are most affected

The scales of the legs become pushed out by the burrowing of the mites The legs become rough in appearance and two or three times normal size Irritation is produced and laying and health are affected Lameness can also be caused

Control measures The scaly portion of the leg should be painted with one or some of the following sulphur compound, sump oil and kerosene 50-50, DDT preparations Washing the legs with warm water and soap prior to the application is helpful Treatment will need to be repeated a few times every three or four days

Prevention is the best method with this complaint This is reasonably easy of attainment with incubator-hatched chickens, which merely require to be kept away from infection

DISEASE PROBLEMS IN WHICH PREVENTION CAN PLAY A PART

LEUCOSIS OR FOWL-PARALYSIS DISEASES

A major cause of losses on poultry units, leucosis complaints include the following general symptoms Birds waste away and paralysis usually occurs mainly in birds about two to seven months old A pullet may appear healthy but be affected by leg weakness Pearly eye, enlarged leg shank, large liver, gasping, drooping wing, are all symptoms of the complaint according to the area affected Laboratory diagnosis is advised, as many deficiencies in feeding such as lack of sufficient riboflavin, manganese, vitamin A, vitamin E—also worms, head lice, rickets, tick fever—can cause paralysis (Also, do not confuse with "layers paralysis"—a leg weakness which occurs in cages Usually treated by placing birds on floor for a period) As with all diseases it is suggested that every endeavour be made to build resistance by feeding rations with adequate riboflavin (milk powders, greenfeed) and mineral trace elements Stale, overcrowded rearing quarters and "stress" conditions are a predisposing cause of disease

Leucosis is responsible for a heavy mortality rate in poultry Owing to the fact that birds only "go off" one or two at a time, its insidious effect is not always readily noticeable Losses of over 20 per cent of growing and adult stock may occur—a considerable economic loss In many tests 50 per cent of the mortality which occurs with layers is due to leucosis

Control measures There is to date no method available of using a drug or vaccine treatment to control leucosis-type diseases Measures that are advocated for reducing the level of incidence are on the lines of breeding resistant strains and rearing young stock in isolation Some strains are more resistant to the disease than others and when stock from a susceptible line that has not experienced the trouble are brought in contact, leucosis cases occur Checking birds for this characteristic in progeny testing work as well as laying ability is advisable (See p 79)

Control by Breeding Methods. A method that can be used by the farmer breeding his own stock replacements is selection for this factor. Check the mortality levels in various families being raised for this type of trouble The use of stock which has been checked for this trouble at least reduces the use of birds in which the disease is developing, some possibility of transmission via the egg, and also breeding from susceptible birds. Use families breeding resistant lines for raising replacement stock after being checked in a farm breeding programme. Considerable work has been done at Cornell University, U S A on these lines by F. B. Hutt and R. K. Cole.

The disease should be treated as if contagious Red mites must be eliminated from rearing sheds—they may spread the disease from one bird to another.

The other recommendation is to rear chickens on fresh ground or in intensive sheds in isolation a considerable distance from adult quarters—a division fence is not a safeguard This isolation starts from day-old stage in the warm brooder. A period up to 90 days of age is suggested by workers on this question Adult stock should not be allowed in the area at any time, and care should be taken with contact by operators between the old and young bird quarters

For further information on the various leucosis complex diseases refer to *Diseases of Poultry*, by T. G. Hungerford.

TUBERCULOSIS

This is often confused with leucosis Symptoms are a loss of weight and marked wasting of the birds with some paralysis The general appearance of the feathers is dull and the comb pale When birds on post mortem show yellowish or greyish nodules on the intestines, spleen and liver this disease should be suspect, and laboratory diagnosis should be obtained.

Control Control is administered by the various State Departments of Agriculture and veterinarians—rigid cleansing and hygiene, combined with restriction of the poultry from free ranging over a whole farm, and disposal of reactors to the T B. test are involved.

For further information refer to *Diseases of Poultry* by T. G. Hungerford, or your State Department of Agriculture.

PROBLEMS DUE TO ACCIDENTS IN FEEDING

POISONING

This at times causes considerable losses through errors in preparing feeds, or through birds gaining access to poisonous plants or substances. The safest plan is to use only greenfeeds that are well known, and to remove obvious weeds Fowls will eat these when greenfeed is chaffed, although they will usually avoid these weeds when allowed choice on range. *Spray* materials such as arsenic, DDT, or cyanide will cause poisoning Salt will cause poisoning, particularly with chickens, if given in excess

Tolerance of salt is fairly high, particularly if birds are gradually accustomed to increased doses The normal amount required is ½ per cent

of the total feed but recent work indicates this may be reduced This may be increased when being used as a control for vices, but amounts fed in excess of 4 per cent can be expected to be poisonous

Various insects can also cause poisoning, ants for example

Symptoms In most poisoning cases the birds stagger, lose use of legs, may have convulsions, often a marked thirst is in evidence, and the comb colour is affected Diarrhoea is also a symptom

A complete description of symptoms and descriptions of various poisonings, plants, insects, and materials, is contained in *Diseases of Poultry*, by T G Hungerford

BOTULISM OR FOOD POISONING

Botulism occurs when the germ is present in decomposing feedstuffs old bones, mouldy wheat, old carcasses, old marrows, or any decaying refuse The birds become paralysed to various degrees and usually lie down Diarrhoea is usually in evidence

Control is by ensuring that poultry have access only to foods that are in reasonably fresh condition and free from any signs of decomposition

PROBLEMS THAT ARISE THROUGH ENVIRONMENT

FEATHER PICKING AND CANNIBALISM

Feather picking can be a considerable source of worry with chickens and adult stock Chickens attack toes or feathers and adults may almost entirely bare one another of feathers, and this may progress to cannibalism and cause losses

General experience with feather picking indicates that a number of cases can be due to incorrect feeding and the conditions under which chickens or birds are kept and these must be rectified Other cases will occur for no apparent reason in spite of good conditions Debeaking can prevent these problems arising

Among Chickens

Outbreaks may occur for the following reasons

1 *Monotonous diet* in battery brooders, in particular with feed such as pellets or all mash lacking bulk—can be relieved by providing some green feed in addition to the pellets or including sufficient crushed oats in all mash A control has been obtained in some cases by giving in addition to the usual ration a daily feed of a mixture of crushed oats plus 12 per cent meatmeal and 1½ per cent salt, plus manganese sulphate ½ ounce per pound of salt used

2 *Deficiencies in feed* These may include any of the following or combinations of them Lack of salt (½-1 per cent should be normal inclusion in mash grain feed or ¼-½ per cent in all mash) Lack of meatmeal (at least 3 per cent of high grade meatmeal or fishmeal and up to 15 per cent needed) Lack of riboflavin (5 per cent milk powder or more may be wanted in the mash) Lack of vitamin A (greenfeed or oil or powder substitutes—check levels in Chapter 14) Lack of vitamin D_3 (sunlight or

oil or powder substitute—check levels in Chapter 14) Lack of manganese (due to small proportion of bran and pollard—add approximately ½ oz manganese sulphate to each 100 lb of all mash) Lack of vitamin E symptoms with ruffled feathers and excitable chickens (If combined with other symptoms listed in Table 25—then feed fresh wheat germ to chickens as soon as possible Vitamin E in powder form would also be included in the ration)

Chicken rations set out under Feeding (Chapter 14) are adequate in all respects

The above causes, and particularly lack of bulk, or salt, or meatmeal, can be common causes of outbreaks of trouble among chickens

3 *Brooder conditions* Overcrowding in the brooder (do not exceed six chickens per square foot in battery brooders or two chickens per square foot for floor brooders up to one month of age)

Lack of sufficient feeding or watering space (Provide, when available one side only, about 6 feet of feeding space and 1½ feet of watering space per 100 chickens to four weeks of age)

Humid, stuffy, ill-ventilated brooders and brooder rooms are bad Sufficient ventilation must be provided in brooder rooms so that they do not resemble a hot-house—the best indication is whether the operator finds the air sweet and fresh for working purposes

Some cases of trouble have been attributed to shafts of sunlight showing up the toes Red paint or cellophane on windows have been used by some to prevent this trouble, or brooder position has been altered

Some outbreaks may be caused by a chicken catching its foot or wing on a feeder or wire-netting—any affected should be removed quickly

Two or three inches of chaff or some finely divided material should be used for litter when chickens run in floor brooders. Lack of occupation, and also exposed toes, will often start outbreaks when chickens are run on sand or grit or bare floors Litter material is essential to provide the necessary occupation for chickens for this type of brooder.

Treating affected chickens When chickens are pecked, paint affected spots with some dark solution such as stockholm tar, boot polish, or dye

Note Increasing the percentage of salt and meatmeal and providing ample crushed oats is usually one of the first husbandry moves, the mixture mentioned previously gives good control

Occupation is the other factor—greenfeed to pick at either chaffed and spread on top of the feed or in bundles Meat bones or livers have also been used (Refer to debeaking—the control method normally used—*but* conditions also need adjustment as indicated)

Among Adult Birds

The factors of incorrect feeding and environment have been discussed as causes, but no hard and fast rules can be laid down for feather-picking

Strains of poultry feather-pick in one area and not in another—it has been advanced that certain strains are prone to the trouble

Feeding rations appear to be the cause in some instances, but other birds on a similar ration do not give any trouble The system of housing

has an effect, but even this is not conclusive Birds under intensive conditions are more prone to feather-picking than birds on range, but heavy outbreaks of cannibalism have occurred where unlimited range has been available to stock Various apparent causes will be listed with controls that have given satisfactory results in most cases

1. *Lack of bulk and minerals in the ration* A mash made up of grain or crushed grain can cause feather-picking owing to lack of bulk and manganese (Include a percentage of crushed oats and also add $\frac{1}{2}$ oz manganese sulphate per 100 lb of mash and include chaffed greenfeed or lucerne chaff)

Note Rations set out under Feeding are satisfactory rations—adjustment has been made for bulk and minerals

2 *Lack of occupation* Birds need to have some occupation or vices of this nature develop Deep litter is very helpful as a control in this direction or a well-grassed open range Birds kept on wire (or being reared on wire) will develop picking to such an extent that mechanical means such as debeaking (referred to later) should be carried out Feeding of a crushed oats etc mixture mentioned above either at intervals or available as free choice may help as a control

3 *Monotony due to environment* Maintain a good depth of deep litter Endeavour can be made to promote some interest in the feed Replace or stir feed occasionally

4 *Overcrowding in houses* Outbreaks will occur for this reason, and the remedy is obvious An allowance of under 2 square feet per bird in an intensive house is inviting trouble Even when overcrowding is avoided some outbreaks will occur Outbreaks may start in some pens with conditions similar in all respects to others where outbreaks are not experienced This is one of the perplexities of feather-picking troubles

5 *The "social level in pens" will stort outbreaks* If strange birds are placed in pens—either male birds or hens—they will be attacked by the others as strangers Also some birds for no particular reason other than the "hen-peck order" or "social level in pens" will be picked by their fellows and they will have to be removed For this reason it is very desirable that birds be reasonably even in development and that all the stock reared together be brought in together if possible

It is sound practice to bring in at the start more hens (and also more males if flock breeding) than necessary to enable some to be taken out later for culling or because of sickness It is asking for trouble with fighting and picking to try to build up the pens a little later, and this applies particularly with young pullets

6 *Need for type of nest to protect layers from other birds* The provision of nests that are in darkened conditions is highly desirable The colony nest is excellent for this purpose (Refer to Chapter 16) Exposed shallow nests mean that when birds are in the act of laying, or just after laying when the cloaca (vent) may protrude (particularly with young pullets) other birds hanging about the nest may start picking at it and an

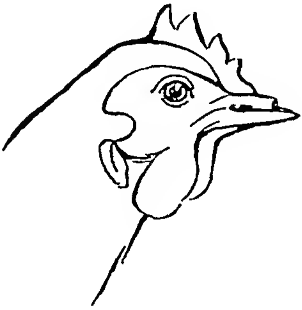
outbreak is on the way This can start habits that will mean many birds being found in the pens "picked out" It is often hard to find the offenders —some birds develop this vice and a watch must be kept for them Hence use colony type nests or individual nests with only a small open front and in the darker portion of the shed facing away from the light If birds are laying on the floor they may be induced to use the colony nests by having nest eggs, or using nest material such as good-quality shavings

7 *Depluming mite*, referred to earlier in the chapter, may set up irritation and cause a bird to pick at its own feathers This may be the cause of an outbreak of trouble, as other birds also pick at the bird when blood is visible

8 *Vent gleet* may cause irritation and start cannibalism Treatment in commercial flocks is not generally recommended for this condition Birds affected should be removed from breeding flocks in particular The condition is characterized by an offensive-smelling discharge from the vent Where treatment is attempted, swabbing with 3 per cent chromic acid every third day, also the use of stockholm tar has been suggested

Treating birds that have been picked It is essential that any birds that are picked should have the affected portions painted with an "anti pick" salve Stockholm tar, boot polish, or dyes can be used and it may be necessary to isolate the birds until healed

Debeaking as a control for feather-picking and cannibalism Many instances occur where in spite of good housing and nesting conditions, coupled with all necessary feeding adjustment measures, feather-picking and cannibalism will occur In battery or laying cages, particularly where more than one bird per pen is housed, this will be needed In these cases debeaking is carried out by cutting the upper beak half-way between the tip of the beak and the nostril This is the method with chickens also



This gives control of the trouble. This is best done with a commercial debeaking machine which cauterizes as well as making a clean cut Observe maker's directions in its use A gauge on the machine can make this operation easier for the operator. (Some use a knife or a small "clipper" or secateurs for this purpose) It will probably be necessary to feed grain in troughs for a few days after this where birds are normally fed in the litter, but birds on all mash can eat after the operation. The practice of debeaking ensures that the trouble does not start It has become part of husbandry practice. Pullets in Random Tests are now usually debeaked at about 17 weeks Birds appear more contented, and feed waste is prevented When operators do not wish to debeak, small plastic or metal spectacles have been placed on the birds by clipping them into the nostrils. Debeaking is considered the most efficient for commercial use

EGG EATING PREVENTED BY GOOD HUSBANDRY

This problem is not likely to be a major one on well-run plants Darkened nests of the colony type are an efficient safeguard, as the birds do not see the eggs as in open shallow nests Sufficient depth of nesting material prevents broken eggs, which start egg eating Nests must be kept free of vermin or hens will start laying outside the nests, which is a predisposing cause of the habit If an outbreak occurs a few china eggs left on the floor for the offenders "to bang their beaks on" has worked well as a control Also control by feeding correct rations with ample calcium, hard-grit, manganese sulphate and vitamin D_3 to ensure good shell texture (refer to Feeding, Chapter 14) Thin-shelled eggs break easily and once an egg is broken all hens will join in eating it The rule here is prevention by good nesting conditions, a clean house, and a balanced feeding ration Debeaking also assists as a control

WATER BAG AND OVERFATNESS

This occurs as the result of ovarian cysts and some types of ovarian troubles due to various complaints such as dropsy or pullorum disease The bird waddles like a duck or penguin in a nearly upright position with the abdomen nearly touching the ground Ruptured oviducts also cause this position Internal laying due to overfatness or oviduct abnormalities will also cause water-bag condition Overfatness in birds frequently occurs in household flocks owing to feed lacking sufficient protein, combined with heavy quantities of feed, causing troubles of this nature, also a prolapse of the cloaca This latter type can be prevented by balanced feed There is no treatment for the above conditions

BUMBLEFOOT

Odd cases of this condition occur on most farms It is suspected that this trouble is due to germ infection, but predisposing causes suggested are conditions that cause a bruising of the feet This can be due to birds flying down from roosting in trees or from high roosts The ball of the foot is usually affected Treatment can be carried out if desired by opening the inflamed portion, cutting in line with the tendons of the foot (not across), cleaning out, disinfecting, and then binding the foot

POULTRY TONICS

Poultry fed correctly and under good husbandry conditions should not need tonics Sometimes when pullets do not appear to be progressing as desired in spite of good conditions some stimulant may help Molasses (1-2½ per cent level) is helpful in this regard, and claims have been made for proprietary mineral mixtures, antibiotics, etc

HEAT-WAVES AND HOW TO MINIMIZE THEIR EFFECT ON POULTRY

Reference is made in the chapter on Efficiency Practices to heat-waves (see pp 452-3), but a reminder under diseases section may assist During heat-waves many birds are needlessly lost, simply on account of their surroundings * Sheds must be provided with a roof of reasonable height and be either painted to reflect heat or be of a material that heats up less than iron or have insulation under the roof It is vital that provision be made to have a sufficiently large gap under the roof at the rear, plus a door at the back or a hinged shutter at floor-level These are to be opened in hot weather to allow a flow of air where the birds are—at ground-level.

It is very important that water be available within the shed—birds cannot walk far for water on a hot day and will not cross open sunlit areas or jump up to high waterers Water too far away has caused many deaths in heat-waves Greenfeed areas between sheds help keep temperatures down Water space provided should be enough for hot weather. Also spraying the litter will help, and spraying on the roof is a great help When a breeze is present losses are not usually great, but on still days in poorly ventilated houses and with readings at the century mark heavy losses can be experienced Slatted or netted side or Dryden type sheds are recommended—they cover needs for all seasons under most conditions Do not disturb birds unduly—let them burrow into the litter to avail themselves of the lower temperature The first hot day of the year is the worst for heat losses—and always open up the shed early in the morning when a hot day is in the offing The main rules for floor operations apart from correct shed construction, spraying facilities and green area surrounding sheds therefore are.

1 The shed well opened with floor- and roof-level ventilation

2 Ample water available, and check need for spraying

Note Any birds showing distress can be quietly caught and dipped in water and placed in the shade in a draught of air. This must be done early if the birds are to be saved—beyond a certain stage they will not recover

* Laying birds in cages cannot adjust their conditions—it is vital that provision be made for spraying on the roof of the laying-cage sheds or that misting devices be used to enable regular spraying of the birds in the cages or the roof of the shelter under heat-wave conditions.

SUMMARY

1 Diseases of poultry under present-day conditions can be prevented from being a major hazard This is made possible by the availability of improved husbandry knowledge and preventive vaccination practices

2 Inefficient husbandry is more often likely to be the cause of poor growth with stock than stock-source or feed

3 If any major outbreaks of trouble occur make immediate contact with the appropriate specialists Symptoms of some common diseases are listed

4 The necessity for correct feeding and rearing conditions, combined with the elimination of pullorum disease by purchasing from blood-tested stock to obtain healthy chickens, must be realized This should be followed by attention to coccidiosis, deworming, and the use of vaccination as necessary to save possible economic losses

5 The importance of maintaining a close check on poultry to control external parasites is stressed

6 The use of correct housing conditions, and small unit pens, safeguards against many disease problems, including respiratory troubles

7 Husbandry, breeding factors, preventing "stress", and isolation practices as a means of minimizing losses from leucosis are suggested

8 Controls for feather-picking and cannibalism are discussed Heat-wave control measures are given Preventive measures for accidental poisoning are listed

9 The golden rule in relation to disease problems is "prevention is better than cure"

CONCLUSION

There are many and varied disease conditions, but endeavour has been made to give only some rule of-thumb directions These cover diseases that can be prevented or reduced in severity by the adoption of correct methods of handling the feeding, rearing, and housing of poultry For further information on those referred to, and for information on infectious and contagious diseases of poultry, the reader is referred again to *Diseases of Poultry*, by T G Hungerford, the third and enlarged edition of which has been published (1962) in the Australian Agricultural and Livestock Series for Australian conditions For some further information on diseases in the S E Asian Region reference to "Diseases of Poultry' by P Sene viratna, University of Ceylon, is also suggested

INDEX

INDEX TO AUTHORS OF REFERENCES MADE TO BOOKS OR ARTICLES

APPENDIXES 1-8

(Giving particular infarmation for use by field officers in developing areas.)

APPENDIXES 1 TO 8

An Indexed Guide to the Contents

IN AREAS where poultry production is being initially developed, or is in early expansion stages, this section of the book has particular value as the source of additional material and is suggested for officers in particular, and also for private operators It can be very valuable for all areas, whether they are only starting or already possess a highly developed poultry industry.

Appendix 5: Training courses for poultry keepers.

Main field indicated as management (p. 684); need for correct simple-type units, as will be used by trainees, to be in operation at the training centre (p. 684); background to needs for the course (p. 684); tentative basis and schedule for the course (p. 686); points on economics (p. 687); points on advanced or second stage of training (p. 688); details of the complete self-contained demonstration and training poultry unit as recommended for field use (p. 689); plan of unit (p. 692).

Appendix 6: Information on the use of poultry equipment.

The basic needs for hatching, rearing, and feed-mixing equipment (p. 693); the follow-up of local production after early import of equipment (p. 693); care in transport (p. 693); care with electrical equipment for correct installation and use (p. 693); type of equipment—horizontal-type mixers considered essential (p. 694); manual operation of equipment desirable (p. 693); grister or hammer mills, and points on them (p. 694); points on care in handling these items of equipment (p. 694); setting up of a small feed mill (p. 694); weighing scales (p. 695); incubators—a suitable electric type, 2500-egg size, and details for use (p. 700); points on smaller incubators, brooders, and egg room (p. 703); details of dressing room for poultry, points on design and equipment (p. 704); debeaker (p. 705); points on hand-operated equipment for remote areas, and training unit (p. 707).

Appendix 7: From local desi stock in developing areas to improved-type laying birds, and how to carry out a breeding programme.

Basic points on breeding and suitable building to aid work (p. 709); improvement by upgrading and crossbreeding with improved lines (p. 710); advantages of crossbreds (p. 711); the need to maintain and improve lines introduced (p. 711); crisscross breeding (p. 712); simple approach to a poultry breeding scheme (p. 713); facilities needed (p. 713); selection of initial stock (p. 714); pens needed and how recording is worked (p. 716); cockerels to be kept (p. 716); procedure for testing pullets and checking of the results obtained (p. 717); mating of families for following year, and procedure to be adopted (p. 718); summary of the breeding scheme (p. 719).

Appendix 8: Some extra points on MANAGEMENT, for use in developing areas, which may be useful also for developed areas.

Importance of good management stressed, and Questions and Answers approach indicated (p. 721); hanging feeders and their correct use (p. 721); water supply—correct location as a vital need—and also need to avoid overcrowding in a pen (p. 722); deep litter sheds for wet areas (p. 724); soil and climate effect (p. 724); adjustments for snow-affected areas (p. 724); costs to produce a chicken (p. 725); White Leghorns or Crossbreds in villages (p. 726); the need for a high percentage of young birds, and regular culling practice (p. 727); further points on energy levels (p. 728); the vital importance of Management Factors in the keeping of poultry—concerning some points on rearing, laying-sheds, roosts, feed, water, and care in the handling of birds (p. 730).

APPENDIXES 1-8

List of Figures

APPENDIX 1

Feeding of Poultry in Developing Areas

Chapter 14, "Feeding for All Ages of Poultry", contains basic material useful for *all* areas, particularly for extension officers and students Appendix 1 supplies additional information on how these approaches to balancing and preparation of suitable poultry feed rations have been adapted for developing areas, principally in tropical and subtropical regions The use of a simple basic concentrate is emphasized by the author for these conditions It can be used for all ages and types of stock by merely adjusting the proportion of the balance of the ration, which is principally composed of grains and bran—with layers being given added calcium This practice can prevent many problems of transport—only the concentrate, which is mixed at a centre, has to be transported, balance can be added locally Also it is very simple to use It can make possible reasonably good results over a wide area (Those who are specialist operators within short distance of city markets can use rations balanced each for its specific purpose) The concentrate mixture given in this Appendix can be used in practically all areas and for all types of stock, with only some slight adjustments This is referred to in the text

The Simple Concentrate

A reference on this will be quoted from *Poultry Feeding in Tropical and Subtropical Countries* This is published by the Food and Agriculture Organization of the United Nations, and has been prepared by E R Halbrook, Livestock Adviser (Poultry), United States Operation Mission to the Sudan, Khartoom, W J Mueller, Animal Production Officer (Poultry), Animal Production and Health Division, FAO, Rome, 1962-3 (now Professor of Poultry Science, The Pennsylvania State University, University Park, Pa , U S A), and W W Thomann, Animal Production Officer (Poultry), Animal Production and Health Division, FAO, Rome, in collaboration with Hans Engler, Chief Poultry Production Section, Animal Production Branch, Animal Production and Health Division, FAO, Rome

This very valuable publication not only covers basic approach to poultry nutrition, nutrient requirements, deficiencies, and special problems with the feeding of poultry, but it also brings together rations being used in Africa, Asia, Latin America, Australia, and Hawaii References on composition of little-known foodstuffs are also given, and in addition, advice on how to make waste-saving feeders The combination of material in this publication makes it particularly valuable for any officer dealing with a poultry programme in a developing country, and *it is strongly recommended* that he check with his reference library for study of this volume

The reference quoted is from the section dealing with the feeding of poultry in India, and is as follows

India

Mr A McArdle (1963), FAO poultry production adviser to India, recommended the following simple approach to feeding poultry where one single all-purpose concentrate is mixed with various amounts of grains and rice bran for the different classes of poultry It is possible to use one basic mixture for all ages but only if the operator makes slight additions for laying stock In many cases this can be a great help, particularly in remote villages where supplies are difficult

The all-purpose concentrate is composed of

19 lb or other parts by weight groundnut meal
5 lb fishmeal
5 lb lucerne or clover or grass hay meal (if not included supply birds with green feeds)
2 lb bone meal
1 lb hard grit (fine gravel)
0 5 lb vitamin supplement containing 487,500 I U Vitamin A, 90,000 units Vitamin D_3 and 150 mg Vitamin B_2
1 oz manganese sulphate
(Total approximately 30 lb without hard grit)

The feed for the poultry is made up of two portions

I The Concentrate

II The Balance, consisting of various grains and rice (and wheat) bran and up to 20 per cent of other local by-products

The following amounts of concentrates and balances are used to make a complete feed for various types and ages of poultry:

Class of birds	Feed proportions as parts by weight	
	I *Concentrate* parts[1]	II *Balance*, grains and rice bran, etc parts[1]
Laying birds[2] light and medium weight (Concentrate as 20% of the feed)	1	4
heavy birds[2] and meat line breeders and all layers during hot weather (Concentrate as 25% of mixture)	1	3
Growing stock meat birds (young cockerels or broilers) day-old to 8 weeks (Concentrate as 33 3% of the feed)	1	2
meat birds 8 weeks to 12 weeks chickens or pullets day-old to 6 weeks (Concentrate as 25% of the feed)	1	3
Pullets 6 weeks to laying stage meat birds 12 weeks to 24 weeks, if kept beyond 12 weeks broiler stage (Concentrate as 20% of the feed)	1	4

[1] One part may be one pound or one kilo or multiples such as 30 lb or kilos.

[2] This feed for layers has to be used

(a) with shell grit given as free choice or 5 lb shell grit added to each 150 lb of total mixture, and

(b) with 2 5 lb. extra grass meal added to each 150 lb of total mixture or green feed given separately

The composition of the concentrate and of the various mixtures adjusted for 100 per cent formulae and examples for substitutions of ingredients are shown in Tables 26 and 27 These tables contain also a formula for a special concentrate for layers and breeders which may be useful in certain cases, especially for large poultry units

TABLE 26

CONCENTRATES FOR GROWING, LAYING AND BREEDING STOCK

Ingredients	*Concentrates for growing stock*		*Concentrates for laying stock and breeding stock*	
	Per cent (*a*)	Per cent (*b*)	Per cent (*a*)	Per cent (*b*)
Fishmeal[1]	16	—	15	5
Meat and bone scraps[1] (45%)	—	35	—	—
Livermeal[1]	—	—	—	10
Groundnut meal[2]	60	27	37	15
Linseed meal[2]	—	5	—	10
Coconut meal[2]	—	5	—	5
Sesame oilcake meal[2]	—	10	—	5
Lucerne meal[3]	14	14	21	21
Shell grit or limestone grit	—	—	15	15
Hard grit	3	3	4.5	4.5
Bone meal or dicalcium phosphate ..	6	—	5	7
Salt[4]..	—	—	1.5	1.5
Vitamin concentrate[5]	1	1	1	1
Manganese sulphate[6]	0.08	0.08	0.08	0.08
	100	100	100	100

TABLE 27

PROPORTIONS OF CONCENTRATES, GRAINS AND RICE BRAN

	In per cent			
	Concentrates	*Crushed grains*	*Rice Bran*	*Total*
(a) Mixtures with concentrates for growing stock				
All-mash for chicks and pullets up to 6 weeks and broilers from 8—12 weeks	26	37	37	100
All-mash for pullets 6 weeks—6 months cockerels 3—6 months	22	39	39	100
All-mash for broilers up to 8 weeks . .	35	43	22	100
(b) Mixtures with concentrates for layers and breeders				
All-mash for layers and breeders of light and medium breeds	22	39	39	100
All-mash for heavy breeds	28	36	36	100

The concentrates in Table 26 have to be mixed, as indicated in Table 27, with crushed grain and rice bran to get a complete all-mash for the various classes of chickens Part of the rice bran may be substituted by wheat bran.

Additional Items on Concentrate Use

(1) *A simplified method for use*

Should officers be dealing with a programme in a developing area for poultry expansion and some confusion arise, even with adjusting the simple concentrate base with varying levels of other ingredients, the following two simple moves may be helpful·

(a) Just advise the poultry keepers to take the 30 lb concentrate (1 part) and add to this 90 lb. of grains and brans (3 parts) and use for all ages of pullets *and* for layers and breeders This will work reasonably well, and only one mix is then used for all purposes (with limestone grit given free choice for the layers).

(b) For adult layers, the concentrate could be put in one feeder, and grains and bran in another, and they will mix their feed reasonably well

(2) *For Ducks, Turkeys, and Geese*

Information has been given in Chapter 20 on Feeding of Ducks, in Chapter 19 on Turkeys, and in Chapter 21 on Geese. However, again for the case of officers in areas where feed supplies are difficult, the concentrate can be of help. The simple concentrate given earlier can be used as follows, and will give *reasonably* good results:

For Ducks

Day-old to 6 weeks ducklings—Concentrate as 25% of ration with brans and grains for balance (or 1 part plus 3 parts).

6 weeks to market stage and for adult ducks—Concentrate as 20% of ration (or 1 part plus 4 parts) plus shellgrit for adults.

Note: In all cases feed greenfeed.

For Turkeys

Day-old to 8 weeks poults—Concentrate as 45% of ration with grains and bran as balance (or 1 part plus 1¼ parts).

8 weeks to 16 weeks—Concentrate as 33% of ration (or 1 part plus 2 parts).

16 to 24 weeks and for adults—Concentrate as 25% of ration (or 1 part plus 3 parts) plus shellgrit.

Note: In all cases feed extra greenfeed.

For Geese

Day-old to 6 weeks goslings—Concentrate as 33% of ration (or 1 part plus 2 parts) for 3 parts.

6 weeks to market stage (at 12 or 24 weeks) and for adults also—Concentrate as 25% of ration (or one part plus 3 parts) for 4 parts plus shellgrit for adults.

Note In all cases feed greenfeed. This feeding from 6 weeks onward is as a supplementary diet only to range conditions which, when good, greatly reduce feed consumed by geese.

Reference Notes for mixing concentrate, and some further adjustments

Mix the vitamin supplement carefully through the fishmeal and possibly a little of the groundnut meal; then distribute in the full feed after this premix (if supplement is not made with calcium/phosphorus base then add extra ½lb. bonemeal). If buying the vitamin supplement by the *kilogram* (of which ½lb. (227 grams) would be used for the concentrate as given) then the *content should be* 2,145,000 units of vitamin A, 396,000 units of vitamin D_3 and 660 milligrams of vitamin B_2 *per kilo*.

Always use fresh ingredients, and mix and use every two weeks and up to four weeks as maximum holding time.

Where molasses is available locally at reasonable cost, add *at least* 2% to the complete ration, which means about 2¼lb. (1 kilo) added to the concentrate.

Try to provide greenfeed—if not in dry form, then fed wet to the birds; otherwise vitamin level can be increased, *but* give greenfeed in some form *if possible* (and dry meal is the easiest way).

The protein level of the overall ration should be sufficient, even if a fairly high level of paddy (low in protein) was used, as the overall con-

sumption will then be higher and this increases the concentrate intake

This type concentrate can be used in nearly all areas This has been indicated in the opening to this Appendix, where reference is made to fishmeal replacement by milk or meat by-products (or add vitamin B_{12} in supplement if none of these is available, or at low level only) and alternative vegetable proteins can be used in place of the groundnut meal The other items can usually be obtained and the vitamin supplement must be used, it is essential and can usually be provided at some centre

To take widely dispersed examples for adjustments, we have farm-produced milk product (krot) used in Afghanistan as a high-quality animal protein product, tapioca meal used in Kerala (South India) in place of grains, 60% level of rice bran in ration used in Thailand and a high level of coconut meal used in Ceylon—all with successful results Accordingly, variations for the concentrate—and the balance of the feed—can be made provided protein and energy needs, etc, are kept in mind

A simple reference on energy levels of feeds for buying value—to use as the balance of feeds with concentrate base

In Chapter 14 the need to consider energy has been indicated It is shown that consumption of feed according to energy content is the deciding factor on the economics of purchase A ready reckoner on percentage basis is given here as a further guide for officers in developing areas When maize price represents 100% then equal buying value would be approximately milo (sorghum) 96%, wheat 89%, barley 70%, paddy 67%, rice bran 62% and wheat bran 45% (If prices under these percentages it would pay to increase the level in the feed, because although birds eat more, the *total* quantity would cost less when at this price) Some other points also arise For example, if maize and paddy were an *equal* buy on value then the maize would be best—as more *palatable* and would help *egg yolk colour*

Also a point on fibre-level this is *not* a major factor under hot conditions —birds, as indicated above for tropical areas, have given excellent results with up to 60% rice bran in the ration (but lower fibre level is needed in areas with cold conditions)

A few points on Substitute Feeds

Some points on this may be helpful as some of the items may be included under the reference given for balance of feed with the concentrate, under "grains and bran—and up to 20% other local by-products may be included with this also" This is quite a vital aspect, since high energy rations (all-grain) cannot be used in developing areas where grain is usually at a premium for human use, hence by-products need to form about two-thirds of the total ration Some items are

Powdered *tapioca chips*—this is a valuable feed and substitute for grains *Crushed mango kernels* can be used in the poultry rations

Silk industry waste has a potential *Sal tree fruits* have been dried and give good results in trials *Sugar industry waste—molasses* where this is available cheaply it has considerable scope as an ingredient in rations up to 10% has been used successfully (and some areas report higher level use)

Distillery waste by-products and *vegetable and canning industry by-products* also may have potential if available at economic level. For other items refer to *Poultry Feeding Trapical and Subtropical Cauntries*, cited earlier.

Some Village Items

Officers may have in some areas poultry projects that do not call for intensive methods (although, as indicated elsewhere, such methods are highly desirable because of deep litter fertilizer value) and some "no cost" points may help. After all, good officers in the field in some developing areas know that with desi birds, provided they are on range conditions with ample pickings, greens, etc., a considerable profit is made, even with a production rate *well* under 100 eggs per year, *because* no costs for feeding have been paid. This can only apply in favoured spots and with a low level of predators (as these can rapidly reduce flock numbers).

Suggestions which can be given to villagers are:

¼ kilo (½lb.) of groundnut cake for about 12 birds daily—soaked to make it soft for them—can greatly help production.

2 or 3 handfuls daily of soil from the ant hills, full of white ants, can be a great help—a valuable feed for chickens and layers. (Good chickens have been reared on range with white ants, grains and greens as the only feed.)

A RECOMMENDED FEEDER

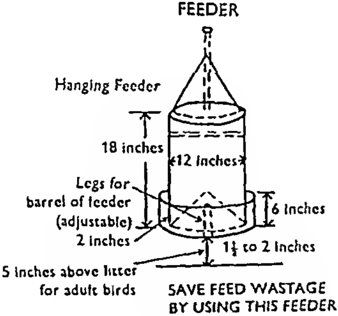


Fig. 1.

Kitchen waste, fish waste and vegetable tops can be helpful for the poultry.

Later, when interest grows, these same villagers may expand to use concentrate feed, and eventually enclosed housing and deep litter practice.

A hanging type feeder is illustrated. This type is suggested as the best for general use. A feeder of this size (18 in. high barrel and 12 in. diameter) will hold sufficient feed quantity for one week for 20-5 layers.

The construction is very important as correct design is needed to prevent costly waste A shallow tray causes this waste, hence *the side of the tray should be 6 in high*, and diameter 16 in to give 2 in right around the barrel (Waste is also saved as vermin cannot get into this type of feeder) The barrel is set on three adjustable legs so that it can be raised or lowered They can be made for the barrel to be set 1½ in or 2 in above the bottom of the tray (by means of 2 holes in the legs to take the supporting bolt and nut) An average opening of 2 in is used—a high fibre or low energy ration requires a larger opening for feed flow than a low fibre or high energy ration The raised portion indicated by dotted lines in centre is to aid feed flow, *and* prevent stale feed collecting in the centre One feeder serves for 50 to 75 chickens and for up to 25 adult birds It can be used for all ages from about 2 weeks to adult stage For young chickens it would be set in the litter and then gradually raised as they grow, until with adult stock it is 5 in above the litter to bottom of the tray (feeding edge to keep level with the neck of the birds)

A lid on top prevents birds resting on it It is suspended from roof by a cord attached to a bar inside the barrel (*Note* If used outside, the lid would need to be extended about 6 to 8 inches all round to protect feed against rain)

A READY-RECKONER REFERENCE SUMMARIZING THE BASIS FOR CONCENTRATE FEEDING USE

One concentrate mixture as the basis of —
"The simple approach to feeding poultry"

THE all purpose concentrate is composed of 19 lb (8½ kilos) Groundnut meal (or equivalent with other vegetable protein), 5 lb (2¼ kilos) fishmeal or meatmeal (or milk products), 5 lb (2¼ kilos) lucerne, or clover, or grass hay ground as "meal" (if not included feed birds with greenfeed), 2 lb (1 kilo) bone meal, 1 lb (½ kilo) hardgrit (fine gravel), ½ lb (227 grams approx ¼ kilo) vitamin supplement *, 1 oz (28 grams) manganese sulphate (*Approx* 30 lb (13½ kilos) weight—without hardgrit)

The feed for the poultry is made up of two portions

I The Concentrate which is shown as © for one part

II The balance, consisting of varying quantities of various grains and rice (and wheat) bran (and up to 20% of other local by-products may be included with this also), has parts shown as O Keep to maximum of one-third grains if possible

* This quantity of vitamin supplement to contain 487,500 units Vitamin A, 90,000 units Vitamin D_3, and 150 milligrams Vitamin B_2 This gives an adequate level for the various rations For example, when concentrate 1 part is used with 3 parts for 4 parts of feed (the most popular combination for layers and young stock) it gives for the 120 lb (54½ kilos) *per lb* of feed 4062 5 units Vitamin A, 750 units Vitamin D_3 and 1 25 milligrams Vitamin B_2, while *per kilo* the corresponding levels would be 9000 units A, 1650 units D_3 and 2 75 milligrams B_2

How the All Purpose Concentrate can be used to make a complete feed

(Any weight basis can be used as a measure 1 part concentrate can be 1 lb or 1 kilo or 30 lb or 30 kilos, and then add parts in proportion as shown)

FOR VARIOUS TYPES AND AGES OF POULTRY

Feed proportions by percentage (Concentrate shown as percentage of total feed by weight)	OR I *Concentrate* © 1 part	plus	Feed proportions—as parts by weight II *Grains and Rice Bran* (etc) ○ parts as needed
Layers or Breeders			
Light and medium weight birds (Concentrate as 20% of the feed)	© 1 part	plus	○ ○ ○ ○ 4 parts for 5 parts of feed
Heavy birds and meat line breeders (Concentrate as 25% of the feed)	© 1 part	plus	○ ○ ○ 3 parts for 4 parts of feed

Note During hot weather use this level (25% concentrate) or 1 part plus 3 parts for *all* birds

This all purpose concentrate needs two additions only for layers or breeders

1 ADD 5 lb ($2\frac{1}{2}$ kilos) shellgrit to the concentrate OR give it as free choice supply

2 ADD $2\frac{1}{2}$ lb (1 kilo) extra "meal" to the concentrate, OR feed greenfeed

Chickens or Pullets			
Day old to 6 weeks (Concentrate as 25% of the feed)	© 1 part	plus	○ ○ ○ 3 parts for 4 parts of feed
Pullets—6 weeks old to Laying Stage (Concentrate as 20% of the feed)	© 1 part	plus	○ ○ ○ ○ 4 parts for 5 parts of feed
Meat Birds (Young cockerels or "Grillers" or Broilers)			
Day old to 8 weeks of age (Concentrate as 33% of the feed)	© 1 part	plus	○ ○ 2 parts for 3 parts of feed
8 weeks old to 12 weeks of age	© 1 part	plus	○ ○ ○ 3 parts for 4 parts of feed

(Concentrate as 25% of the feed)			
12 weeks ald to 24 weeks af age	© 1 part	plus	O O O O 4 parts for 5 parts of feed
(Concentrate as 20% of the feed) (If kept beyond 12 weeks "griller" or "broiler" stage)			
Ducks			
Day ald to 6 weeks ducklings	© 1 part	plus	O O O 3 parts for 4 parts of feed
(Concentrate as 25% of the feed)			
6 weeks to market stage and for adult ducks also	© 1 part	plus	O O O O 4 parts for 5 parts of feed
(Concentrate as 20% of the feed)			

Note: In all cases feed greenfeed—and give shellgrit for adults.

Turkeys			
Day old ta 8 weeks paults	© 1 part	plus	O O 1¼ parts for 2¼ parts of feed
(Concentrate as 45% of the feed)			
8 weeks ta 16 weeks	© 1 part	plus	O O 2 parts for 3 parts of feed
(Concentrate as 33% of the feed)			
16 weeks to 24 weeks and for adults also	© 1 part	plus	O O O 3 parts for 4 parts of feed
(Concentrate as 25% of the feed)			

Note: In all cases feed greenfeed—and fram 16 weeks onward give shellgrit

Geese			
Day old to 6 week goslings	© 1 part	plus	O O 2 parts for 3 parts of feed
6 weeks to marketing stage at 12 or 24 weeks and for adults also	© 1 part	plus	O O O 3 parts for 4 parts of feed

Note: In all cases feed greenfeed—and give shellgrit for adults This feeding from 6 weeks onwards is as a supplementary diet only to range conditions which, when good, greatly reduce feed consumed with geese

APPENDIX 2

Points on Housing of Poultry with Adaptations for Tropical and Subtropical Areas

In Chapters 4 and 12 in the book, considerable information has been given on housing and the layout of farms The structure of most of the sheds has been given primarily for areas where very cold temperatures may also be experienced, as well as temperatures ranging to the levels of 35°C (95°F) to 40°C (104°F) and over The designs given in this Appendix cover the basic housing needs common to most areas, but *adapted* as the result of experiences in these regions In the main this involves an *increased "opening up"*, thus increasing the *ventilation* for the sides of the sheds This makes it possible to work deep litter on a successful basis where high temperatures, humidity, and high rainfall at certain periods of the year (monsoon) would otherwise be a major problem The addition of slatted screens at the edge of the roof overhang makes it possible to adjust these sheds successfully if cold conditions periodically arise, or when they are set up in high altitude or *very* wet areas

These adaptations have been proven under these conditions and can be of considerable help to officers working with expansion programmes for poultry in developing areas (They can also be of considerable help to the keeping of poultry in areas where poultry has reached a high level of development, such as Australia This applies because many units still operate with sheds constructed some time ago Alteration to the sides of these sheds to provide for increased ventilation on this basis could be an economic proposition—the gain being in better bird health and production results)

Houses on which some information is given in this Appendix are

1 A low-cost village shed for 15-25 birds, suitable for most tropical areas and using low-cost local materials (for small operators), with details for building given

2 Larger type village sheds for 60 200 birds, with details given

3 A substantial small-unit-pen easily-serviced type shed, for use on Government units—in particular for poultry-breeding programmes and experimental work Both of these operations require identical replicate pens on an easily handled basis for accuracy It can also be used for commercial production because of the higher lay per-bird gain in small groups

4 An alternate type design of housing, incorporating a separate roosting area of open design which can be of help in some areas. (It is usually known as the Dryden type)

5 A larger type shed with low labour needs, for use in most areas where bigger groups are to be dealt with either for rearing, or "broiler" production, or laying purposes

Note The sheds 1 and 2 are the types to be used as mentioned in Appendix 5 under "Training"

1. Points on 15-25 Bird Village-type Shed

THE LOW COST LOCAL MATERIAL 15-BIRD SHED FOR THE VILLAGER

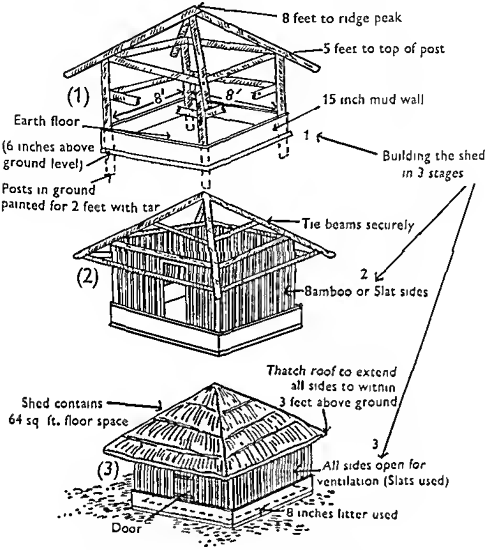


Fig. 2. (Nos. 1-3 indicate shed construction.)

No. 1. This indicates how to start building the shed. The 15-inch high mud wall surrounds the 8 ft. x 8 ft. floor area. The floor is to be 6 inches above the surrounding line and is of rammed earth, and could be set on top of a layer of sand with broken glass underneath to prevent trouble with rats; alternatively, if available cheaply, mud bricks could be used in place of the rammed earth to make a good floor. Corner posts need to be 2 ft. in the ground (painted with tar) with 5 ft. above, and the ridge peak 8 ft. above ground level.

No. 2. Bamboo pieces or slats at 3-inch centres are to be set firmly 9 inches in the mud wall and are attached to the upper beam at 5 ft level with a cross rail in between for added strength. (This is needed to prevent entry of predators.) Bamboo beams are to be tied securely. The door (3½ ft. x 2 ft. in size) is set between two posts (the door is above the wall)

and opens inwards (Some adjust thatching of roof at this point to give a porch-like effect for easier entry)

No 3 The roof of thatch is to be strengthened with bamboo cross pieces as a guard against animals The roof is to be extended sufficiently on all sides to reach within 3 ft of the ground This will then give protection for the deep litter against monsoon rains, and against sun, without the need for shutters, while the slatted sides allow ample ventilation It is stressed that 6 to 8 inches is the litter depth desirable in the shed for adult birds, and that it be kept dry When stirring once a week or a fortnight, turn the litter over thoroughly as if digging in a garden

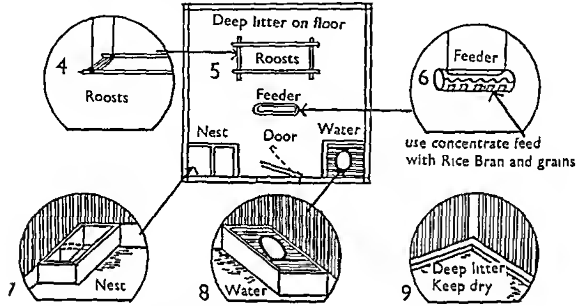


Fig 2 (Nos 4-9 indicate views inside the shed)

No 4 Two roosts 4 ft long and 18 inches apart are suspended (from the four corners to prevent "swinging") about 2 ft above the floor These serve as sufficient space for 15 birds Use at least 2 inch thick bamboo (*Roosts are advised* for easier control of vermin such as tick and redmites, *and* respiratory problems with the birds)

No 5 Diagram indicates position of fitments in the shed, and is self-explanatory

No 6 The 18 inches to 2 ft long bamboo feeder made of large diameter (about 6 inches) bamboo is suspended 6 inches above litter Concentrate with bran and grains (or all mash mixture made up of these) should be used as feed Daily replenishment is needed with this type feeder (the hanging type would be used for holding sufficient for filling once a week)

No 7 The nest 2 ft x 1½ ft in size is made of mud walls nearly the height of the 15 inch shed mud wall, and with a division wall 6 to 9 inches high Nesting material can be of similar type to the litter This nesting space is quite enough for 15 birds

No 8 This indicates the position of the water vessel *It is important that this be set on top of the slats as shown, inside and above the walled area of 2 ft x 2 ft This prevents spillage of water into the litter.* A hole can be

made inside this area to allow water to drain outside the shed A flat bottomed water vessel is best so that birds will not knock it over

No 9. Illustrates the deep litter which is spread all over the floor (other than in the nest or under the water pot) with a depth of about 6 and no more than 8 inches As indicated under deep litter section, it only needs to be kept dry and stirred occasionally to work successfully.

Comments

This low-cost shed (no cost other than labour *if* thatch and bamboo are available on the farm) can give results equal to the substantially-built type made of cement, brick, expanded metal sides and asbestos roof, but its life will be much shorter Replacement, or some repair, of roof thatching —also of wall and some timbers—can be expected within a few years Of course, where a village or householder can purchase materials such as for the floor—cement (or bricks as an alternative), for walls—cement or brick, for sides—expanded metal or netting, for roof—asbestos or other suitable type roof covering, then a shed with a life of possibly 25 to 30 years can be made

The shed is useful for a number of purposes With its floor space of 64 sq ft it can be used for rearing about 20 to 25 pullets to laying stage, *or* 50 meat birds for market at 10 to 12 weeks stage, or to house 15 to 16 layers Excellent results are possible when good management practices are used

For the stock numbers It must be kept in mind that when buying mixed-sex day-old chickens, 45 to 50 must be purchased if 15 pullets are to be raised to allow for half being cockerels and losses in rearing When day-old stage pullets can be purchased (where chicken sexing practice is *employed) then only about 20 at day-old stage would be needed (Also,* this could make possible rearing of cockerels as a separate practice if wished) Accordingly, all the advantages of deep litter practice, and intensive methods of rearing and housing, are available in very low-cost sheds of this type—*when* correctly balanced concentrate feed basis is used, and attention to routine details is carried out as a necessary adjunct

For further information, see details given on the plan (Fig 2)

For cold areas If *cold* conditions are expected for part of year, then suitable type roof covering; then a shed with a life of possibly 25 to 30 use slatted screens on weather side, referred to for shed 5 (large type) in this Appendix (See also "questions" on this aspect in Appendix 8)

Footnote Where a villager may wish to have a larger shed for 20 to 25 layers, the same shed design will serve with slight adjustments made Keep all construction features the same, and same 15-inch dwarf wall, only make the floor area 10 ft x 10 ft and increase to 9 ft height for ridge peak *but* same height (5 ft) at sides, also same overhang Three nests instead of two, water area 3 ft x 2 ft instead of 2 ft x 2 ft (and larger water vessel) and roosts 6 ft long instead of 4 ft , also feeder 3 ft long instead of 2 ft (or use one of the round hanging hoppers if possible) would cover all needed adjustments for the large size shed

2. Points on Deep Litter Sheds of 60-100 Layer Size

Details of a shed 20 ft x 15 ft. are given This can hold from 60 and up to 100 layers total—*with* 30 to 50 per pen (the shed is *subdivided* into two pens each 10 ft x 15 ft) Where desired, sheds 30 ft x 20 ft of similar design can also be built, *subdivided* into 3 pens each 10 ft. x 20 ft. to house 200 layers total—with 50 to 66·7 per pen for the 3 pens.

A shed plan is given, and the number of sheds to be erected can be decided by the number of layers an operator may wish to handle (These sheds are for the larger operator with poultry on sideline basis in tropical areas—the smaller type shed is for backyard type operations)

Details concerning the plan for a shed 20 ft. x 15 ft (Fig 3)

This is a type of shed that can be used for deep litter practice, and in *wet or high altitude areas* can comfortably house 66 layers—33 per pen aod *in dry areas* 80, and up to 100 birds (40 to 50 per peo) *could* be accommodated

The shed is *subdivided* into 2 pens each 10 ft x 15 ft Accordingly, pullets can be run in one pen, and second year birds in the other if wished or convenient, or pullets of one age graded according to their development (Subdivision gives a better rate of lay per bird)

Construction can be of brick walls, with cement floor, asbestos roof, and with expanded metal for sides for a long-life shed, or can be made for efficient village use with thatch roof, bamboo slat sides, mud or mud brick walls, and rammed earth or mud brick floor for an efficient, although shorter-life shed *but* one which involves much less capital investment

Young stock can be raised in the shed on deep litter *This means that they serve a dual purpose—for rearing or for laying use. In each pen* 50 to 60 pullets can be raised *to laying stage*, or 120—150 cockerels or "broilers" for meat to 10—12 weeks old *market stage If* raising mixed sex chickens then 120 are held to 10—12 weeks stage, *then* the cockerels are sold, and space is enough for the 50 to 60 pullets left to be raised *to laying stage*. These can be raised from day-old in the shed with a suitable brooder arrangement.

To provide space for 100 layers under wet or high altitude conditions—and up to 120 or 150 as a maximum under dry conditions, in this type of shed, extend by making ooe more pen, also 10 ft. x 15 ft. size, with identical arrangements in the third or additional pen *If wishing to construct a larger shed of this type, such as doubling to give 30 ft x 20 ft. size*, then the same basis is used as shown in the plan This shed *should* also be subdivided into 3 pens, each 10 ft x 20 ft (200 sq. ft. per pen), sufficient in size for 50 and up to 66·7 adult birds, for the reasons listed previously.

All points for construction would be similar—the only variations would be proportional increase in internal fitments for *each* of the three pens to match the larger size shed. (This only means it is a 5 ft wider and 10 ft longer shed.)

Needs for Each 10 ft. x 20 ft. Pen

Roosts· 3 each 10 ft. in length, instead of 2, maintaining 18 in. between the roosts (4 advisable if large and heavy birds)

Nests: Colony nest 5 ft. x 2 ft., instead of 3 ft. x 2 ft.—which is a *minimum* size correct for 33 birds—and nest should be 4 ft. x 2 ft. if 50 in the pen. (If kerosene-tin type nests are used, then provide 8 nests per pen, set at the same height as for colony nest.)

Feeders: 3 hanging feeders instead of 2 (and note 6 inch height to side of tray is needed to prevent feed waste).

Waterer: 4 ft. x 2 ft. area with slats on top—with waterer over open area inside the dwarf walls—instead of 3 ft. x 2 ft. area.

Doors: Entry with door at end of shed (and communication doors used inside the shed in the divisions) or in front of each pen. *This* is best, to avoid mixing of birds. (*Doors* to be 5 ft. x 2 ft. in either case, with bottom of door 1 ft. above floor (12 inch wall is needed *under* the door).

Note: A good shed will not give good results unless the vital needs for sufficient and correct internal equipment are fully covered.

These type sheds can give excellent results if handled for *deep litter control*, feeding practice, and management procedure as set out in the book. Also, it is again stressed that the sheds be subdivided to give the manifold benefits of flexibility in operation. This can mean handling two-thirds pullets and one-third second year birds; making possible use of space gained by *culling* of birds over the year, and subsequent use of one pen of the shed for rearing space; the facility of grading stock according to development; *and* the benefit of the higher rate of lay in the small groups as compared with trying to handle a full shed.

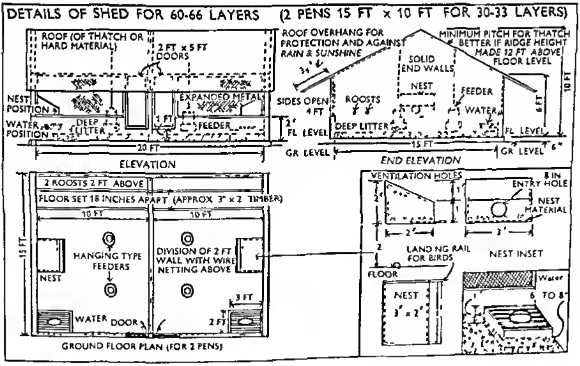


Fig. 3.

3. A Gable Type Shed Housing up to 500 Layers in 32 Pens (Each 8 ft. x 6 ft. with 12 to 16 birds per pen)

Dimensions of this shed are given on the accompanying plan, also some details of construction points are listed. This type of shed is suited to a wide range of conditions, particularly for the very hot areas. For cold

wintry conditions, it is easily adapted by placing or hanging a slatted shutter on the weather side, ***suspended from the edge of the overhang***, so that airflow for ventilation is not prevented.

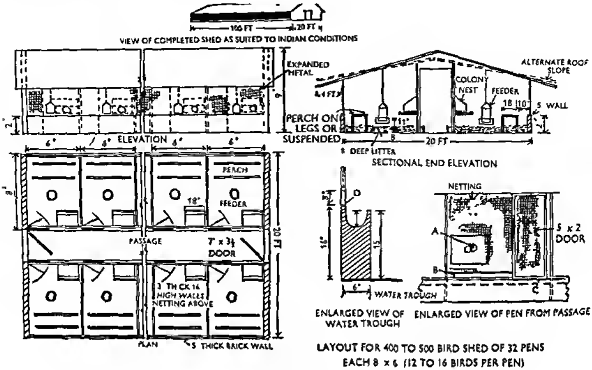


Fig. 4.

Some detoils of construction for the goble type smoll-unit-pen shed with passogeway

Roof: Asbestos or similar hard material (or reinforced concrete can also be used).

Sides: Low cement wall (about 2 ft.) and 4 ft. expanded metal above, making a 6 ft. side.

Divisions: Low wall (about 1 foot high) of brick and netting above.

Ends: Solid—of single brick or cement.

Floor: Cement (or bricks)—with level above surrounding ground line.

Doors: Wooden or iron at ends of passage, and netting doors only for entering pens.

Feeders: Hanging type feeder suggested: one per unit-pen, or make small box type feeder—(18 inches to 2 ft. long for each 15 birds).

Waterers: Low cement dwarf-wall waterer, as shown in plan, advised for ease of handling and built in with shed—also no danger of flooding pens. Birds drink from inside pen through 3 inch wide gap. (If water pots used, construct walled area as for village shed, but using cement or brick.)

Nests: Make a small colony type nest. Set 2 ft. above floor, giving 2½ sq. ft. area but with only a low division, and entry from pen inside for birds through 8 inch diameter hole (made so that lower part gives three inch height underneath to hold the litter). Back with shutter so eggs can be collected from passage.

Roosts: As shown in plan at rear of pen, 2 ft. above floor, 4 ft. long and 18 inches apart—suspend or put on legs. (*Use* 2 in. x 2 in. timber.)

Details from the Plan

A Slide is shown at the back of the nest for collection of eggs from the passageway This circle of metal hangs from a gutter bolt or "hook" and is pushed aside for egg collection It covers a circular hole about 8 inches in diameter (Bottom is to be 3 inches *above* floor of nest) This greatly reduces labour—entry to the pen is only required for the odd eggs laid on the floor Sawdust or rice hulls (or similar material) as nesting material—to be kept about 3 inches deep The birds enter through a similar size hole in front of the nest

B A 3-inch gap is shown through which the birds drink from inside the pen at the waterer which is in the top of the dwarf wall This runs the length of the passageway to form a "no cost" long life water supply method The passageway *must* be level so that the water in the trough is at the same level for the full length of the shed

C A cover can be set over the waterers just under the door This would be to prevent possibility of litter, etc , falling into the waterer at this point, as may occur with walking in and out of the pen (This is optional—may not be needed)

D It will be noted that the inside edge of waterer against the pen, which is shown in cross section, is 1 inch higher than the outside against the passage This prevents any chance of pens being flooded, should any overflow occur, the water will then run away down the passage The waterer can be cleaned out by removal of a plug at the end Further, a slot in the end or a pipe (to be open all the time) is to be used as an aid to control flooding also, as water will flow out of this when it exceeds correct level This type of waterer gives more than ample space for the number of birds for all weathers, is cool, being under cover and well shaded, can be easily seen as to whether supply is available, and is easily cleaned Also it does not involve any major cost in construction, other than labour, because it is set in the top of the division wall which has to be made in any case

Some Features of These Pens

The passage between the pens makes for easy servicing with a very low labour need, as

1 Attention for all routine tasks is under cover—as an aid against heat—or cold—or heavy rain

2 The pens can be protected against an entry with only one door at each end of the shed needing locking Hence birds, feed and eggs can be made quite safe Eggs are collected from the passage quite easily

3 Each pen can be entered independently from the passage for filling of feed hoppers once a week (feeders can be checked by sight from passage as to whether supply has run out), and for stirring and turning over the litter, also for the clean out at the end of the year, and for easy culling (Culling can make sufficient space to enable pens to be cleared to bring in "forward " pullets from rearing quarters, but in big pens this space cannot be used as the full pen has to be cleared This makes a continual operation

Fig 5 The author is shown explaining to an officer concerning the very efficient water system This can be used in all gable sheds with passageway as shown It can be cleaned and serviced from passage while birds drink from the pen, and the pens cannot become wet due to flooding etc The gap above the waterer through which the birds drink, can be seen

possible, with new birds being moved in as adult numbers are reduced, thus giving full use of shed space.)

4. The waterer can be seen as to whether it is full, and all cleaning is carried out from the passage.

5. The shed can be used for any number of birds from 50 to 500 by extension as desired (12 ft. long for 50-60 birds, 24 ft. for 100 to 120 birds, and 100 ft. for 400 to 500 birds). Each pen is replicate of the other and a solid division part way in the shed in this case would be quite in order (in case a smaller shed built first with expansion later on).

6. Construction is economical as compared with large sheds because with short spans from passage to side of shed, light timbers (or metal) can be used and internal divisions are of light netting only, also overhang gives protection against monsoon rain and sun, thus saving the need for shutters under most conditions (as may apply with big sheds with the high sides). This applies for the sides—the ends should be solid. With large pens, for example, 20 ft. x 20 ft. for 100-bird groups, all construction approach would be on same lines, except that gable centre would be higher when maintaining same roof slope—about 12 ft. and the shed would be 44 ft. wide; also, if 50-bird pens are desired, then each pen could be 20 ft. deep x 10 ft. wide and roosts, nests, and feeders would be in proportion; the watering system would be the same—*10 ft. against passage would be ample for 50 birds* (5 ft. would do). Alternatively, if it suits construction procedure, this wider shed *could* have double gable with peaks at centre of pens, and edges meeting above passage—with gutter built in above this. Expanded metal should be used for the sides to prevent entry by predators, but the internal divisions, above the low wall, need only be of *light netting* as only used to separate the birds.

7. The uses of these pens are manifold:

fortnightly—as if digging a garden It will build up further on its own (keep 12 inches as maximum) without extra litter material

(e) The above reasons outline some of the points for the use of small groups as an aid to higher output per bird, and accordingly lower cost per dozen eggs produced (For very large commercial units, possibly exceeding 3000 to 4000 layers, larger pens can be used on the basis of satisfactory returns with lower margins per bird, but big volume output)

(f) The labour question is not a problem with these small units as·

(*i*) watering is automatic for all the pens with the passageway waterer—can fill it for 32 pens as easily as for 1—and a ball cock put at the end can do this automatically if wished

(*ii*) feeding—if the ration contains drygreen in the feed—need only be done once a week—and only the same number of feeders for any given number of birds have to be tended

(*iii*) the deep litter needs cleaning out only once a year

With watering, feeding, and cleaning no longer being daily tasks, small pens do not pose a labour problem when handled as above

4. Points on Dryden Type Poultry Sheds of Gable Construction

An alternate plan is given here of the Dryden poultry shed which covers full details of this type shed when built as a gable design with operations from passageway Design for single-unit type, with lean to roof, has been given in Chapter 12 These type sheds can make possible the holding of more birds in a given area It is not suggested that they be used under most conditions in tropical areas *because of the desire to obtain the greatest possible benefit from the fertilizer value of deep litter* An appraisal is given below of this type shed with the points for and against—and under what conditions it is likely to be most suitable

Some details concerning the Dryden Shed—points for and against

Advantages are —

(a) The Dryden type pen may suit some areas where conditions are very wet, and humidity is high Ventilation is very satisfactory in this type shed and in dry areas there is no litter problem in this type shed and it would not need stirring very often

(b) It can allow of more birds being housed in a given area, than with normal type pen where the full floor area is covered with litter The capacity of 120 to 150 shown applies according to wet or dry conditions—and in very wet areas it may be advisable to house only 100—115

(c) Where respiratory problems have given trouble this type housing, with the birds sleeping on the "exposed" roosts, can give a high degree of control—when over-crowding is avoided

Disadvantages are that

(a) the supply of valuable fertilizer is considerably reduced, as all the night droppings—which form a major portion of the manure

available—are in this portion, and the droppings in the roosting portion do not build up in value as with the composting action in the deep litter.

(b) The manure from this portion can only be used in the compost pit—should not be put direct on crops—and will have about one-third nitrogen level of build up deep litter.

(c) Due to the damp conditions which may arise in the roosting portion, smell may develop, also a considerable fly population be produced. Frequent cleaning out and possibly spraying may have to be used to prevent this. For this reason such type sheds are not suggested for urban areas.

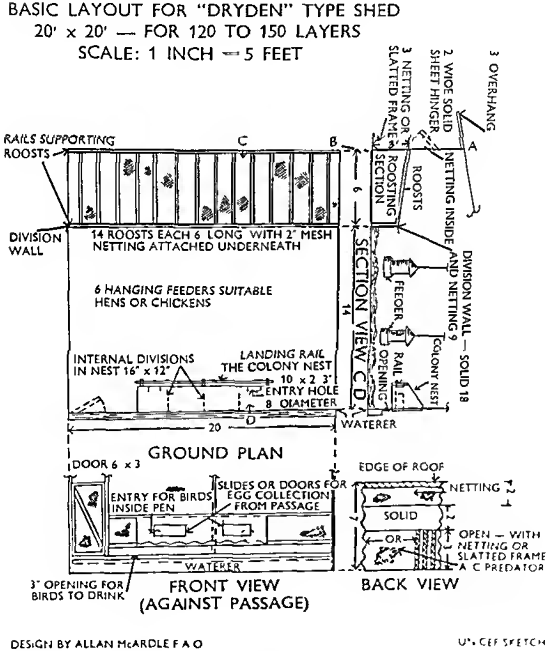
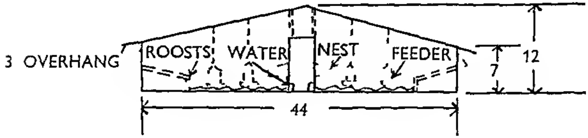


Fig. 6.

For general use, in view of the high return possible with deep litter in developing areas as an aid to agriculture by producing needed fertilizer.

the orthodox type shed, where all droppings under the roosts as well as in outer areas are periodically stirred and mixed together—is recommended, but the information regarding "Dryden" type is given as an aid for some areas This alternate design for the Dryden type shed, with the shed sides protected by slatted frames as necessary, can be successfully used in Australia—as apart from the open-front lean-to type which has been widely used in many areas



ABOVE END VIEW OF CORRIDOR
TYPE DRYDEN SHED WITH 20 x 20 PENS

Fig 7

FOR INFORMATION

Note The End View of the Dryden type shed above also gives an idea of how the type shed with 20 ft x 20 ft pens referred to under 1 would appear (The only variation in the Dryden is that the roosts at the back and side of shed are different otherwise *all construction aspects* the same for water supply, nesting, feeders, shed width and height etc Also the section against passageway is identical in all respects *The roosts* in the ordinary 20 ft x 20 ft would be 3—each 18 ft long, set 2 ft above floor and 18 inches apart for light breeds (or 4 roosts for heavy breeds) and the back of the pen would be as for the gable type shed under 1, i e 2 ft high wall at bottom and expanded metal above

5. Points on a Large Pen Type Shed which can be used for Layers or Raising Pullets or Broilers

This type pen can be adapted in various ways The capacity of each pen of 34 ft x 20 ft would be

Housing layers 200 to 250 according to whether a wet or dry area, and size of birds

Raising pullets To raise to 12 week stage not more than 400 per pen advised starting about 450 at day old stage

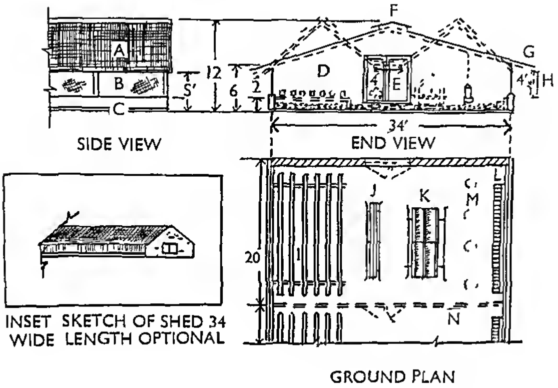
Raising broilers When marketing at 10—11 week stage about 600 or starting not more than 700 at day-old stage suggested

The plan shown gives the general details of the shed Individual items are not given in close detail as reference can be made to I and II for dimensions of nests, type of material to be used in the shed, and so on However a number of points are covered for information in a general description

Reference points on Large Pen Type Shed *with Pens 34 ft. x 20 ft.*

BASIC LAYOUT FOR LARGE PEN TYPE SHED

PENS 34′ x 20 CAN BE USED FOR LAYERS
OR RAISING PULLETS OR BROILERS
SCALE 1 INCH = 10 FEET



DESIGN BY ALLAN McARDLE F A O UNICEF

Fig. 8.

A. This indicates the roof which is suggested as asbestos, but reinforced concrete can be used, or a thatch roof could serve provided rethatched as needed—and more slope Support for roof can be timber or metal (alternatively, *if* wished, double gable construction could be used (as indicated by dotted lines and there would be less need for shutters) but single gable will serve very well and is more economical to construct)

Note: For safety in high winds see that not only is material well secured to purlins, but that purlins are *wired* to rafters which are solidly attached to the uprights

B. This is expanded metal as used on ***outside*** of pens for safety against intruders or predators. It fills in the 4 ft. above the low wall *Internal* divisions can always be of light netting—***above*** the lower 12 inches which is solid (if light netting is taken right to the floor it will eventually break

with the action of the birds in walking up and down against it, also when cleaning out the pen)

C This is the low wall—2 ft high—at edge of pen Need not be more than a single brick thickness—and every 10 ft an upright either brick or cement column (or a post—provided white ant control measures are adequate)

D This indicates the end wall of the shed which is solid—but need not be more than single brick thickness—strength to be given by strong upright columns at edges of shed and against doorway (4 columns—with perhaps 2 more in between)

E This indicates the 6 ft x 6 ft double door at end of shed Similar size door can be used in the internal division The 1 ft under the door is to keep the litter in (if desired this could be removable to permit entry with a hand truck etc Alternatively a large doorway could permit a vehicle to be taken in) Should the internal arrangement of the shed be varied to follow design of I—with central passage and waterers—and pens 15 ft wide made each side, as referred to in this section under "Variations which can be used", then the door would be 4 ft wide only as for I

F This is the central raised portion or "canopy" for roof ventilation—to allow flow of air from inside It can be about 4 ft wide overall and about 1 ft opening (If shed built in an area where driving rain experienced from one quarter in the main, then it could be varied to have roof on one side slightly higher and extending over opening with "curl", or "roll" at end of sheet so that only open one side at top Also, a further alternative for the roof was mentioned under A)

G This shows the overhang of roof—4 ft This is very important to protect the 4 ft opening against rain driving in

H This shows provision which can be made for a hanging shutter This is when driving winds and rain are experienced *or* when chickens inside the shed are in the early rearing stage The shed should *not* be closed up by putting gunny bag or other material *on* the expanded metal side This predisposes to respiratory problems, damp litter etc , as it prevents ventilation The suspended shutter from edge of overhang (or from outside purlin provided about 2 ft 6 inches or 3 ft from edge of shed quite in order) protects from rain—breaks the wind *but still allows for needed ventilation It is strongly recommended that this practice be used with all sheds To be used on both sides of shed* when required as determined by weather conditions (particularly in early chick stages)

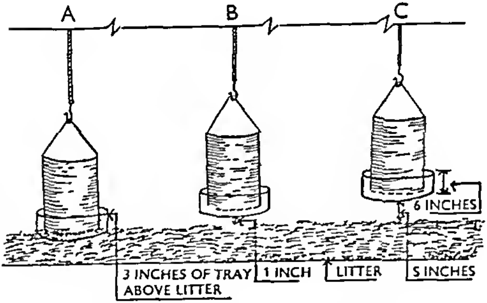
I This indicates the roosts (or perches) which are to be used for layers—and pullets after 6 week stage In this case 6 roosts 18 ft in length, 18 inches apart and 2 ft above floor level are provided (in case heavy birds in pen then 8 roosts may be advisable) When the shed is used for raising "broilers" the roosts would not be installed

J This indicates a 10 ft box type feeder It gives 20 ft of feeding space and would serve for 100 birds If wished this type only could be adopted when shed is used for layers, and then no round feeders would be used In this case 3 would be best for the pen (if full 250 birds to be fed) and the other two could be placed at right angles to the feeder shown, would

be by ends of the nests (K) Alternatively, if it was decided to use round feeders only as at (M) then 8 or 10 feeders (one per 25 adult birds) would be used Both designs have been indicated to give the option for use (the hanging feeder can be used for all three purposes including broilers, but the box feeder is best used only for layers and half grown pullets)

K This indicates the nesting arrangement when used for layers Reference to 4 will show that the two colony nests as shown there but set back to back, would serve for a pen (The dimensions are 10 ft x 2 ft 3 inches, and in this case they would not have slides as shown—as not against passage—but could have these in the sloping top *OR* eggs could be collected through the front of nest where birds enter) Alternatively, as indicated in the Plan, another type of nest could be used to cut costs This would be to have about 4 of 44 gallon drum type nests for 200 layers in pen—one serves for 50 birds The drum is put on its side—either suspended or set on legs—about 18 inches to 2 ft above floor A

HOW TO USE THE HANGING FEEDERS WITH ALL AGES OF STOCK



A — FOR CHICKENS OR BROILERS 2 WEEKS OLD UP TO 4 OR 5 WEEKS — TRAY SIDE 3 INCHES IN THE LITTER

B — FOR CHICKENS OR BROILERS 6 WEEKS TO 10 WEEKS — TRAY JUST CLEAR OF THE LITTER ABOUT 1 INCH

C — FOR ADULT BIRDS 5 INCHES ABOVE LITTER TO BOTTOM OF TRAY (FEEDING EDGE 11 INCHES ABOVE LITTER)

WORK ON RULE OF KEEP FEEDING EDGE LEVEL WITH NECK OF CHICKENS AND LAYERS

DESIGN BY ALLAN McARDLE F A O U N I C E F

Fig 9

circular hole 8 inches in diameter is cut in the middle, and 5 or 6 inches nesting material placed inside Also a landing rail for the birds is put in front and a few ventilation holes put in each end of the drum *at the top* (the material in the nest is at the bottom) Also some provision at top to prevent birds roosting on it—a sloping cover (Officers can refer to Chapter 16 for more details on this type of nest)

L This shows the 15 ft waterer against the wall with a slatted platform about 15 inches wide in front and 12 inches high so that no spillage can get into the litter (This could be set in the middle of the pen if wished, if handling broilers only—in this case the platform would be made wider)

M Indicates hanging feeders of the type shown in Appendix 1 on Feeding If these only were used in the pen then (as indicated under J) 8 or 10 would be needed For chickens and "broilers" small feeders would be used for first 2 to 3 weeks or so—then the hanging feeder would be used At first the feeder is set well in the litter so that only about 2 or 3 inches of the feeding edge above the litter then gradually raise as the chickens grow (keeping *feeding edge* about level with heads of the chickens)

N This is the division in the shed to form the pen 34 ft x 20 ft The length of the shed can be as desired, but it is strongly recommended that these divisions be retained at maximum of 20 ft It does not increase work even with broilers—but gives the benefit of the smaller group effect The division only means passing through a door—and as indicated in this section elsewhere, better returns per head are possible in much smaller groups—but this design has been given to advise for those who may wish for this size pen—possibly for broilers as the main approach

Laying Cages

The use of laying cages is not advocated for most areas in the hot parts of the tropics for the following reasons

(*a*) High temperatures for long periods create problems, particularly where water is not available laid on and at constant pressure

(*b*) The cost of metal cages is fairly high—and is additional to the cost of the shed which has to be of good type construction (as with normal type deep litter shed) to guard against predators, hence it means full shed *plus* cages, with capacity about the same after allowing for passageways

(*c*) It is desired to provide as much fertilizer as possible for agriculture through poultry—as indicated in Appendix 3 This can be the main profit motive in villages with poultry, but with cages the manure is not worth as much as fertilizer and is difficult to handle, etc Similar reasons were cited for the roosting portion of the Dryden shed under 4

Footnote For further information on cages see Chapters 4 and 12 (Should operators in areas of medium or constant temperatures wish to handle these and use the droppings in compost pits only, necessary details are given in these Chapters)

Cooling Poultry Sheds

There are some points which officers should keep in mind when advising operators on cooling of poultry sheds which apply to all of the sheds, particularly under very hot tropical conditions These are

(*a*) That the roof material be of type to keep the shed as cool as possible—with thatch or asbestos or cement preferred to galvanized iron; if iron is used then some insulation material, either as thatch on top or a suitable prepared material underneath is suggested,

(*b*) That if the top side of a solid type roof is painted *white* this reduces temperature in the shed,

(*c*) If either lawns—or green crops—are grown alongside the shed, it will help greatly by reducing reflected heat,

(*d*) Where water pressure is available then a sprinkler on the roof—or a hose with holes to allow a trickle of water on the roof—can be of considerable help

All these moves (*a*) to (*d*), either singly or combined, will aid in equalizing temperature This is needed with young stock, including broilers, for better growth—high temperatures retard this—as well as with layers if being handled in summer period

APPENDIX 3

References on the Practice and Use of Deep Litter as may Apply to Developing Areas

Some points are given here (in addition to the material in Chapter 13) which it is hoped may assist officers who are trying to develop poultry programmes, and may have to deal with many unusual types of objections to the introduction of a practice such as "deep litter" which can be of such overall benefit Some of these (most can be answered from a study of the technical material in Chapter 13) are

"That sheds must be cleared out or conditions will be insanitary"—explain that it works because it is a bacterial process, and gives sanitary non-smelling conditions when handled correctly—that is, shed is dry, is not overcrowded, and the litter is stirred periodically

"That it is far too complicated"—this can be answered by indicating that it only means putting the birds in the shed with about six inches depth of any type material (materials as outlined in Chapter 13 plus others such as sugar cane waste or groundnut kernels or paddy straw chopped up into short lengths, etc , in tropical areas) and nothing else is needed except stirring it periodically and seeing that it is kept dry by having overhang in shed sides and the drinking water kept in a separate area

"That closing up birds kills them"—indicate that this has been so, but that the very low-cost vitamin inclusion in the feed base now prevents all this Always remember of course, if arguments are advanced that birds will do well on range, that it is agreed that in many cases people in developing areas *do* make money by just letting birds scavenge in a village *where* conditions are favourable in well-watered areas, but only when numbers are very low *and* again it is dependent upon the level of predators which

can drastically reduce numbers So indicate that although this is agreed, *if expansion is wanted* then the deep litter practice (combined with a supplementary feed base for the birds) is the way to get it Then the final clinching argument is that deep litter is not just another way to keep poultry, it is a way to make poultry not only lay eggs but work for the agricultural section, that the deep litter is so valuable that it *can* mean in some cases that he gets all his eggs for nothing, that if he only puts poultry in a low cost deep litter shed occupying *less than ½% of an acre of land* he can produce enough fertilizer *to give the full needs of the acre for paddy or maize crops, for example*

Other examples will be given later in this Appendix—and Governments in developing areas have published excellent agricultural texts on how much is needed as fertilizer for the various crops—so it is easy to work out how many birds are needed to give this in the form of deep litter

This can be the most valuable feature with poultry, to make it economically possible to run them where purchasing power for eggs is low and many feed ingredients are usually high in cost The increase in farm-yields in developing areas, where artificial fertilizer costs are frequently very high, makes poultry kept on deep litter a most valuable asset (The deep litter approach is heavily stressed because if the birds are kept in slatted floor-pens, or group or single-pen cages, then the manure does *not* have this high value or ability to be used direct on crops) The only compromise that might be made on this point is for very humid and wet areas where dampness problems arise Then the type shed No 4 in Appendix 2 could be used, and while the night droppings would have to be used like cage droppings for compost heap, the other two thirds of the shed will work for deep litter So when giving information to people handling or wishing to handle poultry with deep litter practice, the points which can be summarized are as follows

Deep litter is a dry compost litter (stress the point of separate watering area as shown in Housing Appendix, to ensure this dryness) and the build-up requires very little attention The basic points to be stressed are birds not to be overcrowded—ventilation to be sufficient—litter to be stirred and kept dry—birds to be given a balanced feed (with the right level of vitamins, proteins, and minerals) Then the result will be that at the end of a year this most valuable organic fertilizer will be available as a no cost by-product which can give an increased output on crops representing a very high return per bird kept in the unit—the poultry *can* be economic for this factor alone

Note Values are quoted in rupees For conversion, work on *approximately* 7 5 rupees to the Australian or United States dollar

A Summary of Points on Deep Litter as an Aid for Agriculture

(The reference here is to work in India)

33-40 laying birds can produce in one year a no cost by product of one ton of deep litter fertilizer, which under favourable conditions with irrigated crops, can make possible the production of an extra ton of grain from one

acre This will be a new idea to many farmers in India, but it is a well-known aid to agriculture in other countries

The one ton of built-up deep litter is a complete fertilizer It can contain the equivalent of 300-25 lb ammonium sulphate (65 lb nitrogen content), 250-300 lb superphosphate (45 lb phosphorus content), 100 lb potassium (45 lb potash content) and 15 lb magnesium, 15 lb sodium and 60 lb calcium plus trace elements *and* the valuable organic material

The 1 ton deep litter can be expected to supply the optimum needs for fertilizer, under irrigated conditions, of approx 2 acres of wheat or sorghum, 1 acre of paddy or maize, ½ acre of vegetables, or ¼ acre sugar cane To produce this the 40 birds needed occupy less than 20 square yards, *but* supply fertilizer for 1,000 and up to nearly 10,000 sq yards, according to the type of crop

The deep litter must be fully composted and built up over the year—a guide is listed to indicate its appearance when "built up" *and* its buying value as compared with "fresh litter which *does not* have this high fertilizer value" It only has high value as the result of the bacterial breakdown of the litter and the manure over one year, one factor only is nitrogen which trebles in level

The 33 to 40 laying birds need only to be housed in a simple poultry shed less than 20 square yards in size, and provided the litter is handled correctly—which briefly means about 1/3 sq yard space per bird, starting with 6 inches depth of waste-type material (leaves, or chopped up straw, or sawdust etc) kept dry and stirred occasionally—the deep litter fertilizer is produced

Handling poultry on general farms can usually show a profit with eggs, but even if it was not so, the poultry can show a very marked profit by the use of their by-product "deep litter" for the agricultural area of the farm—and the increased output can be expected to considerably exceed the grain eaten by the birds *with* the rations which are successful in India, as these are composed of up to two-thirds by-products

Some Points in Detail on Deep Litter as Fertilizer

The purpose of this section is to highlight the value of deep litter to India as the most valuable balanced organic fertilizer available, for intensive forms of agriculture in particular In many parts of the world farmers have handled a poultry side-line just to get this fertilizer, stating that if they only balanced costs on the poultry, they would make a good profit from the improved results in their farming activities, due to the high fertilizer and organic value of the deep litter This is built up from the combination between, and bacterial breakdown of, original 6-inch depth of litter material with the manure from the birds The level of nitrogen in fully built-up deep litter, in average samples when it is 12 months old, reaches about 3% (nearly 20% protein) and it also has about 2% phosphorus and 2% potash level, plus valuable trace elements, etc It is stated to be of particular value in building up light sandy-type soils The deep litter, having been thoroughly composted (its action is that of dry compost, and it is stirred and turned over in the shed about once a

week when handled correctly) is ready for use immediately on the land. (Do not leave it out stacked in the rain for a period after cleaning from the shed, or it will lose some of its value. Cover with earth—or place in a shed—if holding).

1 Ton of Deep Litter—What is in It?

1 ton of deep litter contains *not only needed and valuable organic* material giving a rate of nearly ½ lb. or ¼ kilo per square yard per acre (1000 kilos per acre), but for average samples, approximately 65 lb. of nitrogen (equivalent 300 to 325 lb. ammonium sulphate and the nitrogen to organic matter ratio is approx. 1 to 33) plus 45 lb. phosphorus (equivalent to about 250-300 lb. ordinary superphosphate) plus 45 lb. potash (equivalent to about 100 lb. potassium) together with 15 lb. magnesium, 15 lb. sodium and 60 lb. calcium.

How Many Birds Required, and How Much is Needed for the Land

This will be a natural question. 33-40 birds (according to their size) housed in a shed containing about 130-160 square feet produce approximately 1 ton (1000 kilos or 28 maunds, representing about 25 to 30 kilos per bird). This is enough fertilizer for the full needs of half an acre of extensive cultivation such as vegetable production or orchard (approximate basis of one bird per tree) or one acre of paddy, maize or pasture. For these reasons, where the value of built-up deep litter fertilizer is realized it is eagerly sought after by gardeners and orchardists in particular, also agriculturists and others, as it contains not only the nitrogen phosphorus and potash factors plus trace elements, but also a considerable bulk of organic material which aids in soil build-up. It is rated at three times the value of cattle manure when built up as deep litter (for nitrogen-content, cattle manure is listed in ICAR Handbook of Agriculture 1961 as ·3%—deep litter at 3% is ten times this level). Deep litter contains both liquid and solid manure from the birds—this is a big factor in its high value.

How Should Deep Litter Look, and What is its Worth

An idea of its value will be given on a comparative basis, and a fair price can then be worked out in relation to the local costs of chemical fertilizers. First, in relation to fair price, it must be realized that the basis given is for built-up deep litter which has been handled correctly (kept dry, turned occasionally and one bird housed per 3 to 4 sq. ft. shed space, and it was kept for the period of a year without cleaning out); if a poultry man puts birds in a shed with some sawdust, chopped up straw, or whatever material is used for starting and in about 2 months time tries to sell it as deep litter then it would not be fair value—*this is fresh litter*. This would be a form of adulteration as it were, because the bacterial build-up needed to give it its full value, particularly for nitrogen, is only just starting, at this stage. A guide to assessing the built up nature or age of deep litter is as follows:

Fresh litter would consist mainly of straw, or sawdust, or leaves, or whatever was used to start, but when it is fully built up it is very difficult to distinguish the original material which was used to start the litter; the

whole becomes integrated and it might look almost like a dark chaff or a "meal" in appearance, and is quite free of any offensive smell as would apply with fresh droppings among fresh straw or sawdust. It is also quite loose and "fine" in texture (it has been put on land mechanically by a spreader); in an overcrowded shed it could resemble more the caked manure obtained from under laying cages or a separate roosting area—

Fig. 10. Birds have just been placed in a deep litter shed. Some of these are eating at the feeding hopper of balanced all mash. Hanging hoppers of this type can *hold sufficient feed for one week for 20 birds. (NOTE: The side of the feed* hopper tray was increased to 6-inch height to prevent costly feed wastage). The feed contains sufficient protein vitamins and minerals; *concentrate* feed mixture can be purchased; and mixed with grains and bran to make up this all mash. The *litter* shown is paddy straw cut into short lengths (but many other materials can be used also—just whatever is easiest available and cheapest in the area) The open side of the shed shown above 15-inch wall gives ample ventilation—this opening is protected by overhanging roof
This is the start of deep litter—the birds are placed on the material which is to be used and nothing else is needed

which does not have the same value. Another comparison which may assist as a further guide is that of forest leaves All would know the appearance of dry leaves when they have just fallen from trees, but after a *long* period they break down into a "mulch" which is used in gardens, and it would then be very difficult to distinguish the original leaves in this Hence to be correctly "built-up" litter, the material will be broken down almost completely, and, with the above leads, will be the guide as to its age (It would be in order, if some was wanted for the garden, to take a small portion out after say 5 or 6 months and add some new material This, would be quickly broken down and incorporated in the litter This *could* also apply to suit crop planting times—even to half or more)

Fig 11 The birds in the shed after 9 to 10 months Their droppings have combined with the litter material to form 'built up" deep litter which has nearly reached its full value at this stage, most of the original material has been broken down" *The only attention was stirring about once a week, and it was kept dry* The litter has been opened up to show it more clearly The litter would be removed for use on the fields about 2 months after this period Each 33-40 birds would have produced about 1 ton of deep litter, which, due to the bacterial breakdown and composting action, would have sufficient fertilizer value to meet the full needs of 1 acre of paddy or maize or pasture under irrigation It can make possible an extra 1 ton of grain per acre *This by-product from poultry, when kept on this deep litter system, can be a big aid to agricultural output, and makes possible a double profit with the poultry*

A guide for buying and selling value The comparative basis which can be used is as follows

1 If sulphate of ammonia (20% nitrogen level) costs *Rs 360 per ton* then a ton of deep litter is worth Rs 50 to Rs 55 for this portion when 3% content (If about 6 months old, and only 2% then it would be worth Rs 36)

2 If superphosphate (16% phosphorus level) costs *Rs 195 per ton* then a ton of deep litter is worth about Rs 25 for this portion (2% content)

3 If sulphate of potash (48% potassium) costs *Rs 350 per ton* then a ton of deep litter is worth about Rs 15 for this portion (2% content)

These three items give (for equivalent value *when* these prices rule) a total of Rs 90 to Rs 95 for one ton of deep litter when 3% nitrogen level and about Rs 75 when 2% level *for less than 10% of its weight*, the value of the balance, which market competition will determine for the many other beneficial features that deep litter has for fertilizer plus additional build-up features for the soil, may increase this figure by a substantial

percentage However a basis which appears to have been thought reasonably close to value is approximately Rs 75 to Rs 100 per ton and this gives good value for the agriculturist, while giving the poultry keeper up to an extra Rs 2 from each laying bird, *where he has handled deep litter correctly* This means that the by-product, if these prices rule, can show a substantial extra profit This in turn increases poultry farming efficiency on factory lines, where by-product utilization is a big means of increasing efficiency and returns

What is Needed for 1 Acre of Paddy

The requirements recommended for paddy, in the Handbook of of Agriculture ICAR 1961 lists for lower to optimum amount, were 100-150 lb ammonium sulphate when planting and 100-150 lb a month later (200 up to 300 lb in all) Previous reference indicates 1 ton of deep litter from 40 birds gives equivalent of more than this, plus about 6 times the superphosphate quantity also listed of 40 lb—thus leaving a residue in the soil (particularly helpful if a legume crop follow-up) and high potash level, besides the other listed features plus trace elements—all contributing to the very well-known (in other countries) ability of deep litter to build up soils and make possible maximum output, as it is an ideal fertilizer The Handbook of Agriculture also lists manuring as next only to irrigation in ability to increase yield per acre, and states that when combined with it, the increase is very high Yields of paddy are given as ranging from 1200 lb to 5000 lb per acre The addition of this type of fertilizer, making possible approach to the higher range, has enormous value A yield of 1200 lb increased to 3200 lb by its use (from say 15 to 40 maunds) can mean increase in returns (when paddy is Rs 12 per maund or Rs 33 per quintal) from approximately Rs 180 to Rs 480 (a gain of about Rs 300, equivalent to Rs $7\frac{1}{2}$ per bird) with the use of the by-product from 40 birds (or where one ton of deep litter is purchased from a poultry keeper for a cost of about Rs 100) *In quantity under favourable conditions, 1 ton of litter can mean 1 ton of extra grain* As stated earlier the required number of birds need occupy only 160 sq ft of area with deep litter and the only material needed to start it is 80 cubic feet of waste—either leaves, or sugar cane, or maize stalks, or groundnut kernels, or chopped up paddy straw, etc , and the birds are then kept on this original material for one year—with periodic stirring as the only attention needed

Deep Litter Fertilizer for some Other Grain Crops

The question may be asked as to the effect of this fertilizer with other grain crops such as sorghum, maize, and wheat which are widely grown in India A considerable percentage of these crops are irrigated, and the details listed apply only to these situations where irrigation is used

Sorghum is listed in the 1961 ICAR Handbook of Agriculture as a heavy feeder and for the irrigated crop a pre sowing application of 100-105 lb superphosphate and a top dressing of ammonium sulphate of 50 lb (six weeks after sowing) Reference to the details of "1 ton of deep litter—what is in it" indicate that ½-ton would give this level of super

phosphate equivalent and up to about three times the ammonium sulphate level needed. Accordingly for sorghum the by-product from 15 to 20 birds could suffice for 1 acre—and the Handbook lists yields of dry crops as 400 to 800 lb. and *with well manured irrigated* crops as 1500 to 2000 lb. per acre.

Maize is listed in the Handbook as a crop which requires heavy manuring, for which 50 lb. nitrogen (equivalent 250 lb. ammonium sulphate) is the optimum dose. It is further stated that where no organic manure is available use a mixture of 150 to 250 lb. of ammonium sulphate and 150 to 250 lb. of triple superphosphate per acre, which is fairly close to the equivalent of the average content of about 1 ton of built-up deep litter (300 lb. ammonium sulphate and about 100 to 120 lb. triple superphosphate) when combined with the organic material and potash in the balance of the 1 ton of deep litter. Accordingly, the by-product from 40 birds would be needed for 1 acre, and the handbook lists the yields of dry crops 600—700 lb. per acre and *irrigated crops under heavy manuring* from 1500 to 2500 lb. per acre.

Wheat is listed in the Handbook as being rarely manured as a dry crop, but where irrigated, a split application of 30 to 40 lb. nitrogen and 20 to 30 lb. phosphoric acid, and in the case of phosphate deficient soils, farm yard manure in addition. Reference to "1 ton of deep litter—what is in it"

Fig. 12. The details concerning this photograph are given in the text. The crop on the right is the normal 30 ton crop with ordinary fertilizer practice. The crop on left is a 70-ton crop per acre with deep litter from poultry used. The height of the crop can be compared with the men in the photo. Due to heavy weight the crop was falling over. This illustrates the extremely high value of deep litter as fertilizer.

indicates that about ½-ton average-sample deep litter provides 30 to 32 lb nitrogen and 22 lb phosphorus—plus potash and the ½-ton organic material Accordingly the by-product of about 20 to 25 birds on deep litter would be indicated for 1 acre The Handbook lists out-turn of dry crops (rainfed) as from 400 to 700 lb per acre and irrigated 900 to 1250 lb —with yields under favourable conditions of manuring and cultivation up to 1 ton per acre

Sugar Cane and use of Deep Litter

This is a crop widely grown in India It is listed in the 1961 ICAR Handbook of Agriculture as a heavy feeder It is stated that a 30-ton crop removes from the soil 80 to 105 lb nitrogen, 75 to 315 lb phosphoric acid, 63 to 180 lb potash and 66-75 lb calcium, and that adequate manuring is most essential

Nitrogen needs are indicated on a range of 120 lb to 250 lb or more per acre Many treatments are recommended, with the general recommendation that one-half to two-thirds should be given as organic manure with remainder in the form of ammonium sulphate Farmyard manure is the main source suggested for the organic manure Groundnut oil cake has also been used as part of needs in some areas *Yields* are stated as ranging from 10 to 30 tons in various areas under ordinary conditions It is further indicated that under good conditions of manuring and irrigation two and half times average yield can be obtained, also that in heavily-manured canal-irrigated areas yields of 60-70 tons per acre and sometimes more are obtained

The results of a 1964 trial in the State of Andhra Pradesh indicated that deep-litter use can make possible these higher yields Alongside sugar cane, giving usual yield for the area of 30 tons and up to 35 tons per acre with normal treatment using ammonium sulphate (300 kgs) plus groundnut oil cake (200 kgs), was an acre on which approximately 4½ tons deep litter—and no other fertilizer—was used, and a yield of 70 tons was obtained—a 40 ton increase (This quantity of deep litter would be available from about 150—175 birds in one year) On costs ruling at the time, the fertilizer for the 30-ton crop cost Rs 200 while the market value, if a poultry farmer were selling the deep litter, for the 4½ tons would be about Rs 400—but if the farmer was running the poultry it would be a no cost by-product The 30 tons was stated to have been sold for Rs 56 per ton or Rs 1680 total (or Rs 1480 above fertilizer cost) The 70 tons returned at this price Rs 3920 or Rs 3520 above fertilizer cost—or an *additional* gain of Rs 2040 (In effect, in this trial, the deep litter from *less* than 3 birds produced one ton of sugar cane)

The *gross* return represented about Rs 20 per bird in a year in this particular trial Another way of working this also, in case the farmer cannot obtain a large amount of deep litter, is adding it to the normal treatment in which case the deep litter from 66 to 80 birds—about 2 tons—would be needed for the extra gain of 35-40 tons indicated above

(Other results reported indicate more than doubled yields for varied crops such as paddy, ground nut, chillies, ragi and grapes)

A Comment on the Grains Eaten by the Poultry

Some may query a marked increase in poultry numbers on the score that cereal grains needed for people would be used in much greater quantity. This is a sound argument, but it does not allow for the unique factors which apply to poultry here at present, and also with a marked expansion in numbers Firstly, poultry in India can be, and are being, fed efficiently on feeds which are composed of over half and up to two-thirds *by-products*, thus using grains for only about one-third of the poultry feed or in effect producing 1 lb animal protein food with 1 lb grains. Secondly, because of the amazingly efficient fertilizer *when produced under this system* (fresh poultry manure has a very much lower value because it has not built up three-fold in value under the 12 month "composting" system of deep litter) it can raise the output of crops here, as has been indicated, by much more than the quantity of grains eaten by the birds This applies because the 33 to 40 birds required to produce 1 ton of fertilizer (for 1 acre or more of land) of the value shown above, eat only about 30 lb of *grains* per year each This represents about 1000 to 1200 lb of grains and the figures given previously indicate an increase of up to 2000 lb of grain from 1 acre from their by-product as fertilizer (This is also quite apart from the 600 lb to 900 lb of eggs which the 40 laying birds would be expected to produce)

A Review of Deep Litter as an Aid for Agriculture

The contribution that can be made by poultry in a country with limited fertilizer supply is quite amazing, with only the use of a simple technique—"deep-litter practice"—to give a double gain of greater profit with poultry and greater profit with agriculture

It can be seen that the value of deep litter as fertilizer is very high indeed—although not widely known at present in India However, as the keeping of poultry in deep litter units continues its marked increase, this valuable aid to agriculture is becoming more widely known It is obtained without major use of land—4000 layers can be efficiently housed on one acre of land with the deep-litter system—and this number of birds can supply 100 tons of deep litter—enough fertilizer for, as an example, 50 acres of intensive production such as vegetables, or 100 acres of paddy or pasture This gives some small idea of the potential that exists for fertilizer value and a widespread heavy demand is now becoming evident

Acknowledgments Acknowledgment is made for the valuable reference material quoted in this Appendix from the Handbook of Agriculture published by Indian Council of Agricultural Research 1961, and also for helpful comments by Dr R O Whyte, FAO Grassland and Fodder Adviser to the Government of India

Note A portion of this Appendix appeared as an article "Fertilizer from your Poultry" by Allan A McArdle and J N Panda in the January 1964 issue of *Indian Farming*

Footnote The specific references in this Appendix have been to India Similar results can be expected where comparable climatic and soil conditions apply for levels of crop production indicated Increased returns with deep litter use can be expected for all areas, as shown by reports from many different localities throughout the world

APPENDIX 4

Points on the Economics of Poultry Keeping, with Particular Reference to Developing Areas

Egg Production

THE basic items involved with the cost of setting up a complete farm, raising stock, annual feeding costs, and methods for calculating returns, have been given in Chapter 3 (with additional material on returns), and variations over the various periods of the year in Chapter 17 under Efficiency Practices

For commercial practice The above can quite easily be converted to terms of local currency The proportion of costs follows very closely for most areas where commercial operation is taken up, since egg production is basically the conversion of one type of food production into another type, and running the "machine" for doing this is controlled in much the same manner in various places where the environment gives normal conditions

Village poultry keeping The main emphasis in most developing areas, however, may be on smaller-unit production of village backyard type In these cases the economic aspect varies housing is less, feed is likely to be a concentrate base only, with local products for balance, cockerels will be raised with the pullets to half-grown stage, and the deep litter will be a major return item for use on crops

Economic basis A very rough ready-reckoner basis in these areas might be

* Investment cost per bird, on a good commercial-type unit, may equal the cost also involved of raising *and* feeding a laying bird for one year

* The proportion of annual or recurring expenditure on a commercial unit may be 75% on feeding the layers, 15% for raising the pullets, and 10% for working expenses and interest

* This needs to be balanced with a margin of about 15%, and up to 30%, over this total to make the operation worthwhile (to come from the returns received for the egg production, cull sales, *and* the deep litter disposal) This will be governed primarily by the rate of lay, and whether feed costs are abnormal, but deep litter value will be a dominant factor also

* A *ready-reckoner guide* to cover this question of egg-production economics on *commercial type units* is as follows

> When the price received for one egg will buy one pound of balanced poultry feed, then a unit obtaining an efficient production rate will pay well Further to this, when it takes the money received for four eggs to buy three pounds of balanced poultry feed then, even with efficient operation, the profit margin is getting very close to borderline returns This guide covers for all relevant costs on commercial basis

Economics in the village For village operation this will vary because the villager has a low-cost type house (replacing portion every few years for labour only, which is taken as part of household chores) and can use his home-grown grains and bran with a concentrate purchase only If his egg

prices were low, and only covered the basic cost of the grain portion and the concentrate with no profit margin, this would not matter as he could make a good return—in some cases a high return—from the use of deep litter on his crops So in this case a different "measuring stick" is used—the poultry unit is part of the complete agricultural operation (This in turn may also apply with a larger unit for a bigger landholder in agricultural areas) *Refer to Appendix 3 for further information on this aspect*

Meat Production

Commercial basis If a unit is to be operated in a large city, where hotels and higher-paid sections of the community may be concentrated, poultry-meat-production units on orthodox lines, as with production in Australia for example, may be set up In this case broiler rations specifically balanced for the purpose, and meat or broiler type chickens will probably be used A rough breakdown of costs *might* be 30% for day-old cost, 55% for feed cost to market stage, and 15% for depreciation, interest, brooding, mortality cost, and general working expenses In addition to the total costs for these items, a margin of 10% to 15% would be needed for a reasonable profit The dominant factor in this type of operation will then be the management skill of the operator in getting high returns—well-ventilated sheds, dry litter, comfortable conditions, and considerate attention will pay dividends A very useful suggested reference for this type of production in developing areas is *Broiler Production in Pakistan*, Ministry of Agriculture publication by John B Blake, FAO Agricultural Officer

Village meat basis The orthodox approach as indicated above does not apply for the agricultural or village areas as a general rule

Several reasons apply Preference has grown up for a small desi type bird because this has been the custom for a very long time Another powerful reason for this preference is that a small bird is for one meal This is very important in these areas where no refrigeration facilities are available—the live bird is killed shortly before the meal and there is no "carry-over" Another factor that weights the economic scales is that the desi-type bird, as indicated previously, has no direct production cost, so those which survive, although only in small numbers, have not cost anything—this makes it hard to compete against (Factors such as conformation, etc , mean little in these circumstances)

A further factor is that where chickens are purchased from Government centres (normally widely distributed to try to help people with very restricted transport facilities) these are usually mixed sex chickens This means that the cockerels are there—*and* if they are crossbred chickens the cockerels are a very nice bird at about 10-12 weeks of age—and this side of the enterprise does not then represent a loss In a case like this no special facilities are needed The same shed that will house layers can be used, and there is room for the cockerels *and* the pullets up to 12 weeks, when cockerels are taken out for market and the pullets have then sufficient room to the laying stage The feed, too, need only be the same simple concentrate (A point which may help officers here is that if the cockerels can be separated early they will grow better, even if only those that can

be detected at one month—but it is possible to pick crossbred cockerels from White Leghorn males x Rhode Island Red females at *day-old* by the pullets having small wing feathers while cockerels do not This can make possible separate rearing, with cockerels having 33% concentrate in the feed for the first 8 weeks, instead of 25% as with pullets to 6 weeks)

Part-year Production Possibilities in Developing Areas

Problems may arise in many developing areas through lack of sufficient quantity of marketing facilities—cold storage, transport facilities for long distance movement of eggs, and so on Also prices received vary quite considerably throughout the year, and in the very hot summer—as in India, for example—we find that not only does production fall in the hot weather but, in turn, the price of eggs also, since people do not buy eggs freely in hot weather

One method that can be used to deal with this problem is indicated in Chapter 17 under Efficiency Practices The variations in returns with pullets can be seen for different periods of the year In India one has a high winter-period price also—hence it can be a very good proposition to run layers for 7 months in this high-price-egg period only, and to raise the pullets in the shed in the other 5 months (and the valuable deep litter is still available as after 5 months of rearing use it is then used for the layers, followed by a complete clean out) This practice *can* return more money over the year for the following reason If an operator has three pens or sheds, he has two of them full for 12 months with layers (while the other is used for rearing) thus occupying two-thirds of shed space for the year If he runs for 7-months lay, he uses all three pens for seven-twelfths of the year *but* at the highest price and production-rate period, so he actually collects more eggs, but has no summer-time problems

This should be given very serious thought where marked egg price variations occur in this way It also helps in disease control, with the "all in, all out" arrangement If chickens are of mixed sex the cockerels are still available and can raise 50% more than by the usual procedure Assessment of price fluctuations for eggs and the returns for cull for age birds can indicate whether to apply the method in any given area (For village units it can reduce work in difficult months, and it means that only one shed need be built by the smaller operator) Accordingly, it is suggested that this economic practice has much to commend it in many areas

These additional points will, it is hoped, be of value to officers dealing with developmental programmes They indicate the variation in approach needed for the difficulties with a village or sideline type operation as compared with the orthodox approach possible with large units, in or close to a large city, with facilities for services for stock, supply, services, equipment, feeding rations, and a market

The meat production aspect also varies in similar fashion It is again stressed that short-term production (7-months lay) has many advantages in certain areas and it could be of value to check on this approach to economic production

APPENDIX 5

Training Courses for Poultry Keepers

THESE points may be of assistance to officers who are called on to conduct training courses, particularly for areas developing or expanding their poultry industries. It has been found in field work that concentration on *management features* is the most needed aspect, *and* that people should be trained with the type of unit they are likely to handle—not at large farms demonstrating advanced methods which confuse their approach to the subject. These aspects come at a later stage if they expand to bigger units but only a few of those trained may like to specialize. (The basis given could also be quite useful in areas such as Australia, for agricultural colleges and the like, which sometimes give short courses for those wishing to handle small household flocks.)

The suggestions which follow cover a simple basis for people who are undertaking poultry keeping as a backyard and sideline operation. They emphasize the value of *management of the birds as the important feature*, under conditions where stock and prepared feed are available to an operator engaged in small scale operations. The volume of production in a country can be very considerable indeed when operations of backyard or sideline type are widespread, and these are of great importance in developing areas, as distinct from larger units which operate in or by large towns.

It is stressed that, to give a wider coverage and the "follow-up" needed, some reference material for those being trained would be helpful, in the way of a publication covering points dealt with in the course. It is hoped that this Appendix, coupled with the information in the book, will be of help to officers engaged in the responsible task of training the poultry keepers. It will be noted also that it has been stressed very strongly *why* it is considered that the training, to be effective, *must* be given at a centre which has the correct type of village sheds, erected and in operation. To assist in this respect a description and plan of the unit required are given.

Accordingly, *the course should combine (a) lectures, (b) practical demonstration, and (c) a needed simple follow-up reference guide.*

Suggestions for the Poultry Training Courses

Basic Approach for Training Schools for Small Operators with Poultry

First Stage

Background. It is suggested that there is very little need for material on

(1) Breeding or incubation, *because* day-old or partly-grown stock is usually supplied from a main centre;

(2) Feeding, *because* all mash (the complete ration) is usually supplied ready mixed *or* a ready mixed concentrate base—with only the addition of bran and grain then needed;

(3) Disease, *because* the veterinary service is usually made available to poultry keepers.

Therefore a schedule is given for "a course of one-week duration". This is considered sufficient time to cover the basic management factors.

which are the main need for *small operators* in the first stage of any project, *when conducted at a Unit or Centre where the village units are shown operating correctly, and the trainee receives his own copy in his own language of the course material as a reference* (This should contain the information necessary for implementing the simple poultry practices explained in the course.) Further time involves personnel and funds which could be used otherwise, or for a greater number of people to be given the short course. It is thought that the greatest benefit and profit to the largest number of people in agricultural areas will come from having small poultry keepers, who run backyard units, eat most of their eggs, *and* have the fertilizer from the deep litter for their crops.

Second Stage

Training for larger operators This would apply only to the limited number who wish to keep units of larger size than about 100 birds—where market facilities make it economic to do so. They would have shown desire and aptitude for this by their efficiency or expansion of operations. They would then spend some weeks, at a later stage, at a suitable extension training centre or farm, working on the phase in which they may wish to specialize. This may be a larger egg unit, or a meat production unit, or a hatchery, etc.

Course for Poultry Keepers in Villages who will Handle Small Flocks

Background to the main needs for the First Stage Poultry Course

Operation is on household production lines only, hence a long course—costly in funds and time of personnel—is not needed. Incubation and breeding need not be covered. They (villagers) buy the chickens or receive them from Government Centres. Give only one short lecture on how to care for a desi (local breed) hen when setting, why improved breeds are used, why the improved breeds are crossed to improve lay. Then explain that desi hens, when mated with pure *or* crossbred cockerels from the improved lines, produce chickens which lay more and larger eggs—*if* given the correct complete balanced food or an added concentrate mixture.

Feeding Only a very limited approach is needed, explain that they can get the concentrate and need only know how to mix it with rice or wheat bran, and grains, or they can just put each in a separate feeder (concentrate in one, bran and grain in the other) and leave it at that—the birds will balance it. (A course of many days or weeks on what makes up feeds, etc., only confuses the issue—it may be needed with extension personnel, but not with the smaller poultry keeper. In view of the time needed to produce a trained nutritionist, a course of longer duration than a few talks, plus a practical demonstration of how it works, is not envisaged.)

Disease Indicate that good management, with correctly balanced feed, will maintain resistance to and reduce the level of *disease*, and *if* disease should become apparent, they should call the veterinary officer. Apart from direction as above, plus the use of *preventive vaccination* (*particularly* for "Raniket" or Newcastle disease) being stressed, it is thought best left alone. (A trained veterinarian spends years in qualifying, hence many

talks on this subject for small operators are thought of no use—and may be a source of confusion)

Management and handling of the birds This is the main factor that concerns the small village operator Accordingly, if the training centre has a *field demonstration unit* (layout and details are given in this Appendix) with (*a*) *village-type 15 bird shed unit in operation,* one with chickens and the other with adult birds (or more than one of each if possible, and (*b*) a shed for 70 to 100 birds consisting of *2 pens* in 20 ft x 15 ft shed, enough can be demonstrated (*The designs for these are given in Appendix 2*) This applies because if he is a small operator he will deal with the one 12 or 15 bird unit If he wishes to become larger he will then have a large shed for 70 to 100, but *retain* 35 to 50 bird groups in the shed because (*i*) there is higher hen-housed lay from birds in small groups (as shown in random sample tests with small groups giving improvement of about 1 dozen to 2 dozen per bird per year over very large groups), (*ii*) less husbandry skill is needed, (*iii*) birds are under less stress, (*iv*) all operations will be the same as for the smaller lots, (*v*) culling is easier and the reduced numbers from culling make it possible to use *part* of the shed for chickens at the end of year In a large shed it is not possible to do this even with culling—hence the need for subdivisions in sheds to enable full use to be made of the space available These are some of the reasons for stressing the small group approach

A Tentative Basis for the Course
(with a suggested timetable)

MONDAY

Morning Settling in quarters at the centre

Late morning and afternoon Inspection of the units in operation, without any set lectures, to watch procedures being used General discussion can be held at the units

TUESDAY Talks and inspections to cover

Morning General introduction on value of poultry and eggs in the diet (meals at the centre possibly available once per day with eggs included) Why it is best to leave Breeding, Incubation, Feeding, and Diseases to the Centre or Government Service to save worry with the flock—taken as a theme Then points on improved breeds, crossing, and upgrading—as general information, finishing with advice to obtain chickens or eggs for the desi hen to hatch, or male to mate with own birds

Afternoon Care with chickens Proceed outside *to see chickens being raised in the village house—on deep litter with balanced feed* Also stress that it is better to have new chickens each year because birds lay most eggs in their first year Cover general points on hen or "cold box" or a small warm brooder for chickens, care with feed and water, and *also* the need to keep litter dry for chickens

WEDNESDAY Talks and inspections to cover

Morning Feed Some background to a complete ration and to concentrate feeding How the feed contains the hidden vitamins needed by the birds, also minerals and protein as a story Then indicate need not

worry"—that it pays to get the concentrate (sold by Government on no-profit-no-loss basis) Indicate the costs with this in relation to extra eggs obtained Also that if mixing own feed, and even only one or two items left out, it can make the operation unprofitable—very few eggs, and deaths among the birds Also that if it is confusing to mix concentrate where buying to use with own grains and bran, then it will work well with adult birds to place the concentrate in one feeder and the grains and bran in another, the birds will balance their ration

Afternoon Care of the birds Water and why it is important (Go to see the shed) Then why care is needed in handling birds when collecting eggs and when entering or approaching the pen—how poultry give results according to the care taken They are a machine for changing feed to eggs, and need regular care to work efficiently Why water should be cool and clean and always available Why feed should not "run out" Why extra care is needed with water supply in summer (Then outside to see the handling of the adult birds in operation, and for general discussion)

THURSDAY Talks and inspections to cover

Morning Deep litter practice How it is started—why it works—how the shed construction affects results—how it saves labour—the high value of the deep litter as fertilizer—*how it can pay to run poultry for this factor alone* explain how it is like "compost" Then outside to see the pens in operation Show how to stir the litter as needed, about weekly or fortnightly, and why it should be kept dry (have some outside shed in wet condition to show effect) Indicate the many materials which can be used to "start" deep litter

Afternoon Construction of the shed How it can be made of thatch (bamboo-lined against predators), bamboo or slat sides, and mud wall Stress low cost but good results possible if well made and floor level kept higher than surrounding ground level Stress vital importance of adequate roosting, nesting, feeding and water space, as shown in plan

FRIDAY

Morning Review of points covered concerning management of feed and water supply, plus care of the litter and the rearing of chickens on deep litter, etc , as dealt with Monday—Thursday A few points on culling practice, infertile eggs, and care of eggs to be discussed Then some points on the economics of poultry keeping

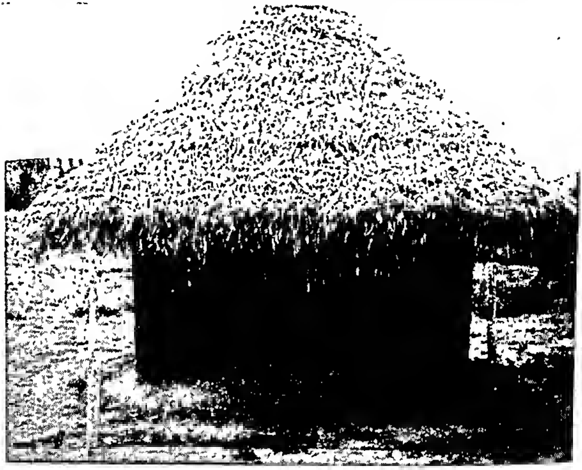
Afternoon General discussion, with each to ask questions and indicate his impressions, to wind up the course Also, encourage them to keep in touch (when at home) with the extension officer in the area for points that are not clear, or for problems

Footnote Each trainee should have received, during the course, a copy of the lecture material used in the course *This is important*

Comments

Where the operators are only to deal with the small shed of poultry of about 10 to 15 birds or up to 25 or 30, this basis should give sufficient coverage, with a period of full-time lectures, talks and *inspections of units for chickens and layers in operation* over one week This would not be

expected to apply if the correct demonstrations are not working at the centre, and also if access to the basic literature indicated as desirable is not accessible. Where adult layers are given, even less time could be taken, *but* it is advisable that care of chickens be given full attention, as with further development in the industry this will be the most likely method of supply. In some cases month-old supply may also be available to make it easier.



Village Type Shed for Training Unit

Fig. 13. A demonstration unit showing the 8 ft. x 8 ft. village type shed. This is one of the two sheds to be built on the unit as set out for training purposes and used in conjunction with the course. The roof is of thatch, strongly interlaced with bamboo to keep the birds safe from predators. The sides are of bamboo slats which are set, at the bottom, in the mud wall (*strengthened* by a cross rail half-way between the top of the wall and the beam at wall height where they are secured at the top. This beam is 5 ft. above ground). The door shown in front swings inwards and is above the 15-inch high mud-wall which surrounds the shed on all sides. (Some make a "porch" for easier entry through the door.) The floor, which is of rammed earth, is level with the base of this wall, which is built *well* above the surrounding ground-line to prevent ground seepage.

(For details of construction see Appendix 2.)

This shed has worked very successfully. The birds are kept inside the shed all the time, and are fed a feed with simple concentrate base. It is a very low-cost structure as only local materials are used and the labour is taken as part of household chores with this backyard type unit. Replacement or repairs for roof and possibly the sides can be expected within a few years.

The Advanced Student on Second Stage Training

Should an operator particularly wish to run an incubator, and engage in poultry production at higher level than this "backyard" type of

operation, then, as indicated earlier, a longer period (envisaged under "Second Stage") would be given and could well be spent working with incubators for a 3-weeks period (see Chapter 9 for references) checking the machine daily, and in between assisting with work on the general farm His general inquiries during this extended period should be a very helpful feature of his training The same basic approach could apply when a man wishes *to handle many more birds*, but not incubation The same feeding and handling procedures apply, but he could think of the *larger* type shed as shown in the training unit, and possibly spend more time on training Should he wish to know the *economics* of further expansion, if near a good market advise from Appendix 4 for both eggs and meat, and discuss 7-month production aspects

It is hoped that the foregoing will be of material assistance to officers engaged in the responsible task of conducting these training operations

Personnel conducting the courses The extension officers would attend at a suitable centre if possible This may be at the Government Farm or Extension Centre, or where suitable demonstration facilities exist They should be issued with their own copies of, or have ready access to (in the Library at the Centre and wherever they may be stationed) the textbook *Poultry Management and Production*, for reference

The period of attendance can be a matter for the Government concerned

A GUIDE TO THE REFERENCES FOR USE AS BACKGROUND MATERIAL AND IN PREPARATION OF LECTURES

For Feeding	See Appendix 1 pp 643-53, *and* Chapters 14, 15, and 18
For Housing	See Appendix 2 pp 654-70, *and* Chapters 10, 11, 12, 17, and 18
For Deep Litter Use	See Appendix 3 pp 671-80 *and* Chapter 13
For Economics	See Appendix 4 pp 681-3, *and* Chapters 3 and 17
For Equipment	See Appendix 6 pp 693-709, *and* sections of Chapters 4, 9, 10, 11, 12, 17 (Part II), and 18
For Breeding	See Appendix 7 pp 709-20, *and* Chapters 5, 6, and 18
For Management	See Appendix 8 pp 720 32, *and* Chapters 10, 11, 12, and 17
For Incubation	See Chapter 9
For Rearing	See Chapters 10 and 11
For Diseases	See Chapter 22—which also indicates further appropriate reference

The Self contained Demonstration and Training Poultry Unit for Field Use

This unit is envisaged as a means of giving the type of training suited to the needs of the small operators Training on Government farms and block units with "pucca" or costly buildings only, does not always have a

desired training effect—it may confuse the student Further, feed handling, etc, shown as carried out with power-driven machinery (needed, of course, for farms of the larger type) may not give him the right impression

Accordingly, we need these—for use to demonstrate with the simple *low-cost* buildings and equipment the villager is likely to use himself wherever training is to be carried out This can, it is felt, assist greatly on our training side The methods we use have to be appropriate to the purpose and as simple as possible If we wish to teach a man to ride a bicycle we do it with one—not with a motor car A plan of the unit is given

Comments

* This poultry unit demonstrates poultry practice for trainees or villagers, with sheds and plant which they can use and can also serve as a guide for a small commercial unit It could also supply feed and stock for small operators setting up close by after training

* 115 layers could be handled for 7 months, with chickens raised in the same pens in the other 5 months, *or* 65 layers can be kept for 12 months, as one of the 10 ft x 15 ft pens then has to be used for raising young stock (This could be used up to 150 mixed sex chickens at day old, then cockerels (if crossbreds) profitably disposed of at 10 weeks, and pullets left with sufficient room to be raised to half- or three quarter-grown stage)

* Under Equipment, the hand mixer (illustrated in Appendix 4 and Chapter 14) is suitable for up to 500 birds A hand crusher, for use in crushing those ingredients needing it, is shown on unit Incubator for hatching is shown also Brooders can be used in either of the laying sheds

* Three sheds are needed (A) illustrates the lead for the small backyard type operator with 15 to 20 layers, and (B) covers for the man wishing to handle a larger unit of up to 100 layers for 7 months of year, and rearing in the same shed or 50 layers plus rearing provision Shed (C) covers for those who wish to hatch chickens and mix their feed with concentrate base (all instructions needed are in Chapters 9 and 14, also Appendix 1) Alternatively, shed (B) can be made of 3 pens each 10 ft x 15 ft and the third pen used for the purposes indicated for shed (C) The hand mixer and hand crusher can handle needs for the 100 layers in the unit, plus supplying feed for 400 layers on units of private purchasers (The total daily quantity of feed for 500 birds is only 120 lb (54 kilos), of which only about one-third may be crushed—balance is obtained in ready to use condition The hand mixer can mix up to 200 lb (90 kilos) at a time) The bin is to store mixed feed

* The incubator, if of 300-egg capacity two-compartment type could, with only one pen of 40 to 50 birds mated for hatching season, produce the replacement stock of 250 300 day-old chickens for the unit plus about 1,000 chickens for outside sale (operational instructions for incubators and also for handling the brooders are covered in Chapters 9 and 10)

* The two 100-125 chick size brooders needed to match this incubator could be worked in the one pen in shed (B) used for rearing (A simple wire netting-covered frame would divide the 10 ft x 15 ft pen into 2 pens of 10 ft x 7½ ft —and this would act quite well as a temporary arrangement, where it was wished to send out some early batches of started stock—

enough space to raise 100 to 8 weeks of age) Then it would be used for the replacement stock on the unit, one lot from 95 to 120 day-old chickens —from a normal compartment hatching in incubator—could be raised to 9-10 weeks old, cockerels disposed of, and pullets then have sufficient space to half- to three quarter grown stage A second lot of similar size could also be raised in the other "half" pen—to be transferred later to laying pen—or some disposed of if very good rearing This applies for 12-months operation If running for 7-months lay—and 115 pullets raised each year—then each pen would be used for rearing (In this case the litter used for rearing the chickens would remain in the pen for the 7-months lay)

* Eggs for market or hatching could be stored in shed (C) as indicated A small safe of bird netting could be also used on the bench for eggs (to safeguard against vermin, etc)

* The correct location for all equipment is indicated in the plan

* Details of sheds (A) and (B) and general fitments are given in Appendix 2

Footnote The unit as an aid and demonstration for agriculture—to show the high fertilizer value of deep litter This plant can serve not only as a poultry training demonstration unit, *but* can also be used to show the trainees and/or villagers the high value of the deep litter for fertilizer use Approximately 2 tons (and up to 2½ tons) of deep litter would be available each year from rearing the chickens and handling the layers on this small unit *averaging* under 100 adult stock

This would give the full fertilizer needs for, as an example, 2 acres of paddy or 1 acre of vegetables or ½ acre sugar cane—with only 130 cubic feet of waste materials having to be put into the sheds at start of the year A demonstration plot of paddy—or vegetables—or sugar cane—with this quantity of deep litter used—against a similar area plot with identical conditions except no fertilizer used, could be very useful indeed, as in many village units this could be the profit factor (The 2 tons of deep litter could be worth $40 if sold, but return up to two and one-half times this, and in some cases much more from increased agricultural return in many areas) Check references in Appendix 3 on "Deep Litter' as to likely increases in returns from various crops with deep litter fertilizer used

Establishment of the Unit

Building of the Sheds

Sheds (A), (B) and (C) to be built to sizes and with methods, materials etc as indicated in Appendix 2 They occupy 64 sq ft , 300 sq ft and 150 sq ft floor space respectively Thatched roof construction is suggested and ordinary walls as in village buildings (also floors)—such as mud bricks No power provision needed—*only water from well for drinking purposes*

Internal fitments and equipment needed for the unit

1 only 300 egg two-compartment kerosene incubator, and 1 battery type fertility tester

2 only 100-125 chick size kerosene floor brooders

1 only hand operated 44 gallon drum type mixer

1 only hand operated crusher.
1 only drum with lid for holding feed not less than 20 gallon size.
5 only hanging type feeders (non-waste type) as shown in Appendix 1.
2 only 4 ft. x 2 ft. size Colony nests for shed (B).
2 only chicken feeders each to give 3 ft. feeding space.
2 only chicken waterers, each to hold 4 litres or one gallon, to be supplied with a tray (this is for sand base for waterer).
50 only yards 5 ft. x 1 in. mesh netting to cover for sides of sheds (A) and (B) and division in (B) plus netting on frame for use with chickens (but only 25 yds needed if bamboo sides on shed (A).
1 only small egg scale and
1 "Raniket" (or Newcastle disease) vaccination kit.

(Refer to Equipment, Appendix 6, for illustration, and some further details of this equipment.)

A SELF-CONTAINED DEMONSTRATION AND TRAINING POULTRY UNIT FOR FIELD USE
SCALE: 1 INCH – 10 FEET

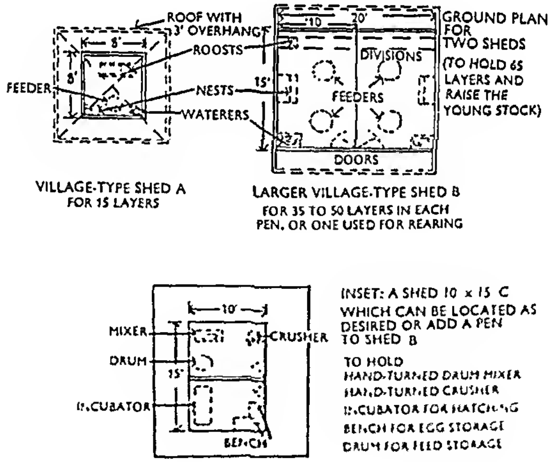


Fig. 14.

APPENDIX 6

Information on the Use of Poultry Equipment

THE progress of poultry expansion in developing countries is in all cases linked with the introduction of new types of poultry equipment This is usually, in the main, for: (*a*) the hatching and rearing of chickens, and (*b*) the crushing and mixing of ingredients for poultry feed Other items follow later to facilitate packing of eggs for market and processing of poultry, but these are not as vital as (*a*) and (*b*), which are needed to enable expansion of numbers and correct feeding of the stock

Import of the equipment is frequently the standard practice in the first stage With the skills usually available in developing countries—as shown by the fine craftsmanship in so many products made there—the next stage, provided some "know-how" can also be linked with the equipment, sees local production coming up, based on these items (It can be said of India, with which country the author has been most closely associated, that examples of practical poultry equipment now being made there, in the form of incubators, brooders, feed mixers, and hammer mills suited for developing areas, are for quality and price competitive by world standards)

In this Appendix some points on installation, operation, and maintenance of various items are given, together with reasons why certain equipment is best in developing areas

Transport This must be handled with care—"dropping" of cases can mean needed equipment rendered unfit for use It needs very careful supervision by the officers

Installation Equipment should be put where it is to work If buildings are not ready, store *under cover*, or equipment may be unusable when moved later

Electrical Equipment Be very careful to connect to the right kind of power, usually supplied for A C Heavy equipment (such as grinders and mixers) needs 3-phase power and geared-up starter switches, while incubators, brooders, etc , need only single-phase *Always* check as to whether equipment is for use with 110 volts or 220 volts If 110-volt is supplied, then *transformers* must be used if on 220-volt supply Always make sure that connections are made *carefully*

The type of equipment for developing areas This is a very important aspect indeed, and a considerable responsibility is thrown on the persons who have to decide on these matters Some projects have been unsuccessful owing to this—*not* because of the operations of the officers assigned to this work It has to be remembered that the equipment is for developing areas and usually these are agricultural areas remote from skilled service facilities

Accordingly it is a paramount need that the equipment be *simple*, both for operation and servicing Automatic devices, as used in fully developed areas with skilled service facilities within easy and quick call, should not be brought in, "manually" operated equipment should be supplied (for example, an incubator should have the eggs turned by lever and humidity controlled by adjusting trays and moving a slide) Automatic control with

these operations can mean a possible lay-up of the incubator if controls break down (the techniques mentioned in Chapter 9 cover the simple type of operation) Brooders need to be very simple also—see Chapter 10 for the suitable types shown The *mixing of feed* also calls for special approach Upright mixers are used extensively in developed areas but are *not* recommended for developing areas They can only handle dry-type feeds, and have other disadvantages also Developing countries have to use many substitutes in feeds, some of a damp nature (for example, high level of molasses), and for this *horizontal open type mixers should be provided* Also they can use alternate power—or be worked by hand if needed Further, since they turn slowly, they last longer and are very easily serviced All these things *must* be considered The crushing of ingredients calls for special attention The need is for careful screening of them by hand or sieve, as many have a great deal of foreign matter (stones or metal) which can break hammers or grinding-plates, so care—and a supply of spares for these—is required

An example is given here of one type of mill with some data on its features and how to operate it

Setting up a small feed mill These points should be helpful in both developed and developing areas, as this is a basic requirement The needs are a horizontal mixer—the sizes may range from 15 c ft to 50 c ft (the larger type mixing up to about 1 ton (1000 kgs) at one time)

This *must* be coupled with either a high speed grister or a hammer mill, to be made so that the cyclone will discharge direct into the mixer when required, or through the alternate outlet into bags The balance of needs is a suitable room and the required electric connection It is essential that a grister or hammer mill be bolted down to the floor (on account of its high speed and vibration) and all bolts must be kept tight Regular lubrication is a "must" Also 3-phase power and connecting with a geared-up starter switch are vital, (a geared-up switch is like starting a car—it goes through the gears, without it, with heavy equipment of this type, it would be like trying to start the car in top gear)

With a high speed grister, or a hammer mill, the capacity per hour will vary according to the type of ingredients Maize or wheat can be crushed or milled in greatest quantity (the high-energy ingredients), while oats or hay could only be put through in much less quantity It follows closely the energy level, for example, maize 1150 units of productive energy and oats 720 would indicate much less oats could be put through The other factor is fineness of crushing—much less can be put through if it is to be crushed finely, but for feeding efficiency it is strongly recommended that *coarse* crushing be used (See references in Chapter 14)

Points on Gristers and Hammer Mills

For comparing the two machines, a grister is very easy to handle, with easy feeding of grains, etc, and gives a very high output It requires the large type hammer mill, with larger hopper, to match this The particle-size of this grister is also very suitable where mixed mashes are being prepared, but large screens can help adjust this for the mill (apart from

milling for pellet preparation, not considered necessary in a developing area)

Servicing for repairs to "hammers" of a mill will be easier than replacing gristing plates, also *alternate* power can be used for a hammer mill The need for dealing with repairs in either case can be controlled by means of supervision of the ingredient quality Grain can be put through a sieve placed in the hopper container, and magnetic filters should also be used if possible Bulky type ingredients—like groundnut cake—can be checked by an operator who spreads them out and hand checks before putting in the hopper Discharge from hammer mill cyclone to the mixer must be arranged, as with grister, (with alternate outlet also) for efficient operation.

For layout of the units in the feed shed, etc , refer to Chapter 14 where this is given (Some variations for developing areas may be used—for example, hand operated chaff cutter may suffice)

A further item needed in the feed room, particularly in developing areas where feed may need to be distributed to sub centres, is an efficient weighing scales Weigh samples of ingredients in buckets and then put in the required number of buckets, it is easier than weighing each batch separately

The Use of Alternative Power Source

A *feed mill* description follows for electrical connection, *but* if electricity is not available, then with a horizontal mixer and hammer mill alternate power can be used

This can be a kerosene, petrol, or diesel engine of sufficient power to operate both units together The mixer position would be reversed as compared with the following layout, to have the pulleys near the hammer mill for convenience of working from one engine Further, this type *could* be set up on a low level, tray-top "waggon", and then be moved from place to place as needed, because it contains its own power unit

Description of the Feed Mill (Illustrated)

To assist implementation of the suggestions given—also installation of the complete unit of grister and mixer

A indicates the 7½ h p motor which supplies power for the grister It is directly coupled to the gristing plates Just in front of this is the adjustment for coarse (*recommended*) or finer crushing The lever with knobs on each end is screwed outwards to give coarser crushing It should *not* be turned in too far It should *always* spin freely Lock it in the desired position by using the lever with one knob only Just under the point *B* will be seen a small handle, which is used for controlling the flow of grain (or other ingredients) from the hopper *Always* start with this handle at the top, and then, only gradually, open it *C* indicates the hopper for filling with the ingredients for crushing (It can take a very large capacity, with flow regulated by the handle shown near *B*)

When crushed, the material (crushed grain or groundnut meal, etc) is blown up through the piping into *D*, which is known as a 'cyclone' Under this cyclone the discharge pipes at *E* will be seen One discharges

direct into the mixer; the other is at the back of the mixer so that crushed material can be put into bags if wished. The regulation of which pipe is discharging is by means of a small handle (with knob on end) shown just by *E*. On the mixer, *F* indicates the mixing drum portion in which the "paddles" turn in this horizontal-type mixer. Also, just below *F* is the edge of the removable portion, so that some ingredients can be put in from the front if wished. (However, another suggestion is made on this which is referred to below.) *G* indicates the driving portion of the mixer; inside this is the driving portion of the mixer; inside this is the 5 h.p. motor and

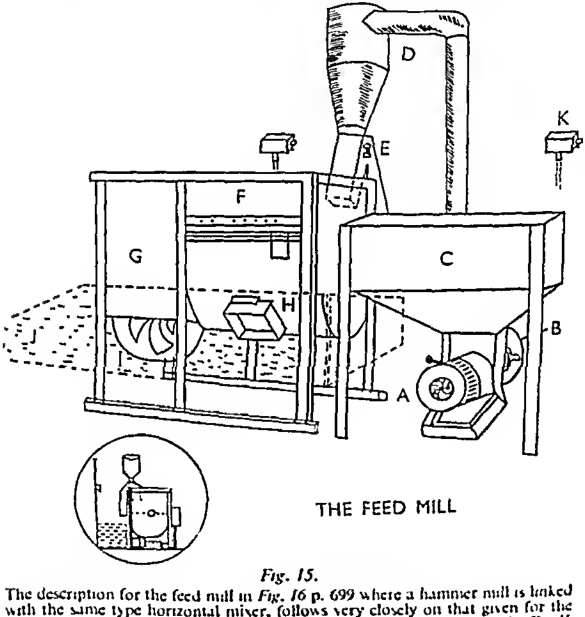


Fig. 15.

The description for the feed mill in *Fig. 16* p. 699 where a hammer mill is linked with the same type horizontal mixer, follows very closely on that given for the feed mill above with the grister. In this case A—C are varied only, while for D—K it is exactly the same as for the feed mill with grister, where covering the cyclone, mixer parts, switches, and platform, etc. The variations for A, B, and C are as follows:

A—indicates the 7½ h.p. motor used, with pulley and covered belt drive, for connection to this larger type hammer mill.

B—indicates the handle used for adjusting the inlet from the hopper, to regulate the flow of ingredients into the mill.

C—indicates the hopper in which the ingredients to be crushed are placed (The inset shows the side view of mill and platform level.)

necessary reducing or worm gear, for reducing the speed to the 30 revolutions per minute for the mixing shaft turning in the drum portion

H indicates the outlet for feed after it has been mixed The slide that fits into this is pulled up and the feed is then rapidly discharged into a bag fixed against this opening—the slides being dropped as soon as it is filled This can be done without any danger to the operator, *but* of course he should not put his hand into the opening for any reason or it could be caught by the paddles

I shows some of the pulleys—in this model of mixer, alternate power can be used if electric power is cut off or not available at a centre Fast and loose pulleys for ordinary belt driving from alternate power are provided

J shows the platform which it is suggested should be made just at the rear of the mixer It will be noted in the illustration—and it is very necessary—that the *front* of the *mixer* can be seen, and the *back* of the *grister* by fitting them in this way it will be right for discharge into the mixer and also for ease of operation All control points for the bagging of feed at *H*, the filling of ingredients in *C*, and the altering of rate of flow at *B*, can be serviced easily *K* indicates the geared up starter switches

The purpose of the platform is to make it easy to put in the ingredients that are not to be crushed The platform need only be about 2 ft to 2½ ft high, and finishes off about 9 inches to 12 inches short of the right hand edge of the mixer, as seen in the illustration, so that the front of the grister is left at normal floor level, *and* bags can be filled with crushed material at floor level as wished Then on the left side just above *J* will be seen a slope—this is a ramp with rough surface—to make it easy to walk up with a bag of any ingredient (Could be steps if wished but a reasonable slope ramp is usually easier to work with) The *INSET* gives a view from the end as an additional guide to the height in relation to the mixer The platform could be much wider and larger if wanted to store bags, etc Also the platform can be *slightly* higher to suit the edge of a truck so that bags are loaded direct from the truck, for example, through a window opening at side of shed for these types of ingredients (Should a hammer mill be installed, then the same type cyclone arrangement must be made A hammer mill unit can be fitted to the grister by point B, to give a dual purpose unit for greater flexibility This is recommended)

These suggestions—and the detailed description given—should make it possible to install this small feed mill to make an easily operated unit Where the points stressed, re ***regular maintenance, particularly for greasing, and*** care taken to keep ***solid objects out of the ingredients***, have been observed, these mills give excellent service

Some General Points and Reminders on Handling the Feed Mill

The operator who is to mix should, for ease of operation just measure *by weight* carefully for one batch of ingredients and record it (for example 50 lb grain = 1¾ buckets might be the amount) then it could be done by measure only for the subsequent lots It is strongly advised that a set of

buckets be made up with the weight of each type of ingredient on it—large buckets for major ingredients, small only for items like bonemeal, vitamin supplement, and manganese sulphate Then the operator only has to put a certain number of buckets in the mixer for any desired type of ration

Then (1) He could put the whole grain by measure into the grister or hammer mill and it is then blown in crushed form into the mixer—*no* further weighing or bagging is needed (*unless* bagging crushed grain to take to some other place—in this case discharge is made from the other side of the cyclone outlet)

(2) He could put the groundnut cake through the grister in the same way It is not necessary to crush each ingredient separately unless wished (when the grister is blowing the crushed material direct into the mixer) Provided the correct measure by weight is put into the hopper, it need not be weighed again as it will be blown direct into the mixer Accordingly, if for example 200 lb grain and 20 lb groundnut meal are to be put in a mixture these can be put through together This can make it easier to deal with the groundnut meal, as it goes through more easily with the grain Hay, in small quantity and in *short* lengths, can also be dealt with, in the same way

(3) While the grain, also the groundnut cake, is being crushed and blown into the mixer, the measures of the ingredients which are bought in crushed form, such as rice bran (or wheat bran), fishmeal, bonemeal, hard grit, vitamin supplement (and manganese sulphate plus salt) are just tipped into the mixer by hand. This is done from the raised platform at rear of mixer as shown in the illustration (In a normal ration only about one third to one half of the ingredients may need to be crushed)

Accordingly, in practice it will be found, that if two people are mixing—with one feeding the ingredients such as grain and groundnut cake into hopper for crushing—the other working with ingredients tipped direct into mixer which are ready crushed when purchased—the items under (3)—then a continual process can be worked out with both helping on "bagging off" the mixture, and as soon as this is done, then a new batch These points should assist in easy flow The plant of the grister or large hammer mill plus 50 c ft size mixer could put through from 1½ to 3 tons per hour (as 1 ton of feed can be mixed in less than ten minutes)—the hold-up is crushing for about half the total, plus time for measuring ingredients and bagging, but much better not to worry too much about speed All ingredients need to be carefully and accurately checked—one small item missed (for example, the 6¼ lb (2 85 kilos) vitamin supplement *or* the 10 oz. (280 grams) manganese sulphate, per 1500 lb mix) would drastically reduce efficiency Also, do not prepare feed for more than 3 to 4 weeks supply—feed becomes stale and the vitamins in it will lose some of their strength—so avoid deficiency problems by crushing grain only as required—and do not hold feed more than one month from time of mixing to consumption by the birds

Some maintenance points on the mill

(1) Check the *grister* frequently for *greasing, and tightening of bolts,* and see that a sieve is made to fit the feed hopper to prevent any chance of stones or bolts being put in with the grain—and possible damage This a precaution additional to the provision of magnetic filters For groundnut cake it would be difficult with the sieve—it could be lifted out when using for this purpose (Hand checking is advisable in this case)

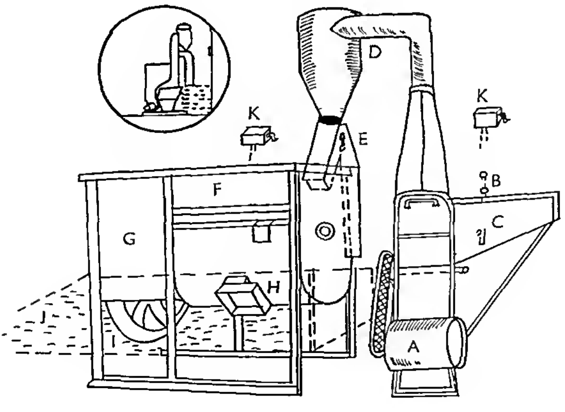
(2) Periodically check the grease cups on the *mixer*—and see that it is kept clean inside the mixing section

Note It is stressed again that care should always be taken to see that large stones or pieces of metal do not get into the ingredients to be put into these gristers (or mills) or damage can be expected because of their high speed operations (approximately 3500 revolutions per minute) This can leave the farm without crushing facilities for some time until repairs can be made The grister (or hammer mill) can do a very good job with most materials, but troubles (or damage) can be expected if this precaution regarding large pieces of stone or metal is not observed Otherwise, provided they are kept well lubricated, all bolts tight, and not overloaded by trying to crush material too fine, or in too large a quantity, they can give good service over a very long period

FEED MILL

(WHEN USING A LARGE HAMMER MILL)

Fig 16 For description see captions below *Fig 15*, p 696



Description of a Feed Mill using Hammer Mill with Horizontal Mixer

In other cases in development projects hammer mills only may be used See illustration p 699 for one of larger type, with mixer The same rules must be observed concerning installation by bolting to floor, speed of operation, avoidance of foreign matter in ingredients, and regular attention to *keeping bolts tight* and *greasing* Variation in capacity according to ingredients, for both gristers and hammer mills, has been referred to

Some points which apply to hammer mills Two points which may cause confusion are (*a*) use of screens, (*b*) care of hammers

(*a*) The screens may be of varying sizes to give small or large particles of the crushed material In general, endeavour to have the larger size particles —coarse feeds give greater feeding efficiency with poultry On this point, if the screen becomes broken, due probably to some foreign hard material (for example, a bolt) having gone in with the grain or hay, it is practicable with most types of hammer mills to operate without any screen and get a sufficiently small particle size *provided* the hammers are in good condition (*Particle size* with grains *not larger* than wheat, barley, paddy, and oats, it is possible that they can be mixed to form feed with concentrate without being put through a hammer mill or crushed This has been quite successful for layers, but in general a little crushing or breaking up of the grain is used)

(*b*) The hammers can be reversed and then turned over to present four surfaces or corners for use, as each corner wears This gives a long life—but make sure that an efficient operator or mechanic alters the hammers, so that they are carefully refastened in position Hammers turning at this very high speed could cause considerable damage if they flew off the spindle, hence observe this precaution

Many other items of equipment are concerned also

Incubators These are a major item As mentioned previously, they must suit the facilities available in developing areas For example, water connection may not be available, hence ' built-in" water supply is needed, all metal construction is needed, in view of sanitation measures, stress of monsoon conditions on timber, and white ant problems

The handling of one type of incubator has been included here—a 2500 egg size model, which is now made in India and considered well suited to developing areas, in view of the good results obtained with its wide use in United Nations assisted projects in India

2500-Egg Standard Type Incubator

Operational procedures in general follow for this type of all metal incubator (as for others) in relation to checking, turning of eggs, incubation temperature, humidity needs, testing of eggs, cleaning of incubators, and routine tasks These points have been dealt with in Chapter 9 on Incubation However, certain items are recommended for this standard-type incubator, which experience has indicated as desirable A coverage of these main needs follows under ' Reference Points Illustrated '

Reference Points for Routine Attention and Operation of Controls as Indicated on the Incubator Illustration

1. Switch No. 1 for control system to maintain desired temperature. (Also indicated at No. 11 is the adjusting lever. This is adjusted by means of a key until correct temperature is obtained.)
2. Switch No. 2 is for the independent reserve control system installed as a safeguard to maintain temperature in the event of a breakdown in circuit No. 1. The adjusting lever for this is shown at No. 12. The connecting plug marked No. 2 would then be inserted in the socket at the top of incubator where No. 1 is placed when working.

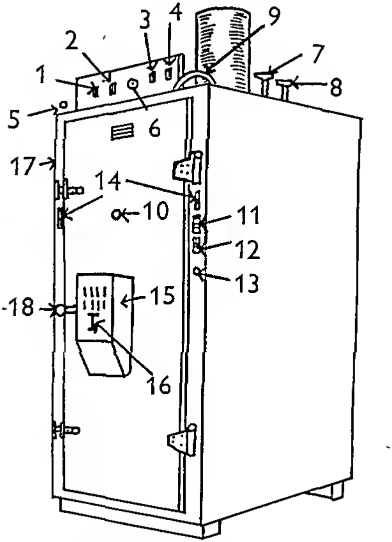


Fig. 17.

STANDARD TYPE 2500-EGG CAPACITY ELECTRIC INCUBATOR

3. This switch controls the light, which is used when wishing to read the thermometers.
4. This is the switch for the alarm bell system. This is not switched on until the incubator is running at correct temperature. Then it is adjusted by setting the lever midway between the two points at which the bell would ring. (This is located at point marked 13.)
5. Vent for exhaust. (This is kept closed for 3 days, then opened ¼ until 14th, then ½ open, and from 18th day on fully open.)

6. This is the indicator bulb which comes on when the heating elements are switched on. This will be turned on and off automatically by the control No. 1 (or No. 2 *if* needed.)
7. Water valve No. 1, at front, worked from the drum of water at top of machine, is to be used only in hot weather season for cooling system of the incubator—would be turned on slightly if temperature rose.
8. Water valve No. 2 is used for supply of water to the water trays to maintain humidity as required.
9. This indicates the point where water is filled in for the wet bulb thermometer supply.
10. Switch to be used when full—or double—heating is required such as when incubator has been loaded with fresh eggs, or after testing eggs, or following a power break. When incubation temperature is reached then it can be switched off (and less current will be used).
11. This indicates adjusting lever for temperature control from switch No. 1.
12. This indicates the adjusting lever for temperature control which is used in the event of control operated by switch No. 1 failing, and No. 2 being plugged in at side of box top of machine.
13. Lever used for adjusting the alarm bell (which is used to indicate if temperature has gone too high—such as in very hot weather—or too low—as when electric power is cut off.)
14. These indicate the thermometers (see temperature table which follows for correct readings.) The wet bulb thermometer is on the left hand side of the incubator and the dry bulb thermometer is on the right hand side. (This location is optional.)
15. This is the outer casing of the unit surrounding the motor which turns the air distribution fan.
16. These represent the inlets or vents for the intake of air. They are usually kept closed for first three days and are then opened until end of hatching period. Should electricity supply fail then the small handle shown can be used to turn the fan occasionally—*also* door to be opened about 1½ to two inches if chickens are hatching.
17. This indicates the humidity control adjustment lever (this operates by raising or lowering the angle of the top water tray so that more or less water surface is exposed to increase or decrease humidity).
18. This indicates the handle used for turning of the eggs. Usually operated in morning and at night at the same time each day. (*Approx.* 12-hour intervals) during the setting period. (This is to be turned *gently;* the eggs turn over in the trays as the handle is moved.) *Note:* As with all incubators it should be set level on the floor. To check this fill the water tray at the bottom of incubator, and if when filled the water is even depth at all 4 corners, then the incubator is level.

APPENDIX 6

Temperature and Humidity Schedule for [illegible]

Period after setting of eggs	Dry bulb reading	Wet bulb reading	
1st to 3rd day	100°F	88°F 90°F	Closed
3rd to 14th day	100°F	86°F	$\frac{1}{4}$ open
14th to 18th or 19th day	99 5°F	86°F - 92°F	$\frac{1}{2}$ open
During hatching period up to 21st day	99°F	86°F - 92°F	Fully open

Note The above applies with all eggs set at the same time When eggs are set in the machine on different dates the *dry bulb thermometer to be held at 99 9°F and wet bulb at 86°F 88°F*

Some Other Reference Points

Before starting the incubator each season have it checked and maintain efficient lubrication of motor at regular intervals during season

* When storing eggs, hold at 55°F to 65°F with wet bulb reading of 50°F to 55°F if possible
* In summer period set eggs within 3 days of laying if possible, but up to 7 or 10 days in order in winter period
* When incubator is only partly filled use centre trays, *but* keep to "staggered" loading system which is to be used with all leadings for best results (See Chapter 9)
* Maintain setting to have indicator bulb cut off at 100°F
* Transfer eggs to hatching trays at bottom of incubator when eggs chip—about 18 to 19 days
* If 4 incubators are being worked at a centre use 3 incubators for setting eggs in only, with No 4 to be used for hatching only This will give better results and easier handling (The 4 incubators can be set together in line to form one machine of 10 000 capacity as all controls and routine tasks can be operated from the front—for reading thermometers, adjusting water, turning eggs and so on)
* Dust, clean, and fumigate inside the incubator after hatch Work on 40 to 50 cu ft internal capacity for fumigation (see Chapter 9)

Kerosene incubators In locations where power is not available kerosene incubators would be used ranging from perhaps 150 to 500-egg models (with, for preference, individual compartments and metal lining etc) The operation of these is covered in Chapter 9

Brooders for raising chickens No reference need be made to brooders as suitable types (electric or kerosene) and how to handle them is dealt with in Chapter 10—also suitable brooder rooms

Egg Rooms On the larger units in developing areas an effort is made to use a cooling device of one of the types described in Chapter 16, and to have some means of testing eggs (These can follow the simple lines of the egg room indicated in Chapter 16)

Dressing poultry This may also be introduced on some larger units, with a small type scalder and picker often used, and an endeavour is usually made to have a small deep-freeze These can work from single phase current and are usually imported in the early stages (with local production possible later)

As this may be of help in a number of areas, a description and a layout plan are given It is stressed that with even this simple equipment (as compared to large dressing plants) a regular routine check by an electrician should be made at least once a year, and the unit and its equipment should be kept in clean condition as needed with "wet dressing" of poultry

A Simple Poultry-Dressing Room

Details for room size, etc , are given in the plan The additional items, which can be obtained through normal local channels possibly near or at the Regional Farm, are crates for holding the birds, some provision for hanging birds after killing before scalding, which is desirable, plus a small tank or bath to use for cooling the birds quickly after dressing Ice water is desirable if possible (some supply of ice can be arranged with the deep freeze) Benches of normal type are also advisable Some general details follow

Plan for a Suggested Simple Dressing Room for Poultry Meat

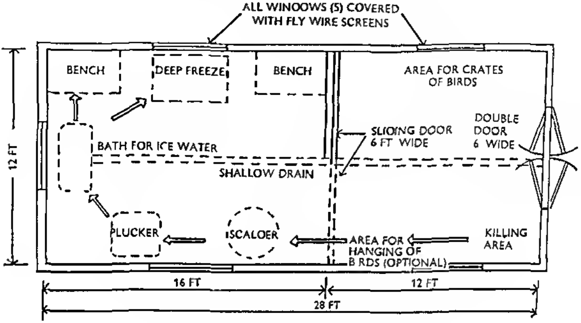
This room is for use with hand killing and a single unit scalder, a plucker and a deep freeze cabinet as supplied It is quite distinct from large meat dressing units with chain system mechanical operation but can be very useful in developing areas, particularly where labour costs are not high

* The overall size of the room shown is 28 ft x 12 ft It is sub divided into two areas for working, as required, by a 6 ft inner wall and a 6 ft sliding door This gives a 12 ft x 12 ft area, which can be "cut off" for killing purposes (and be cleaned separately, while dressing and packing operations are being carried out in the dressing room) The 16 ft x 12 ft area used only for dressing and packing of the birds contains (1) Scalder, (2) Plucker, (3) Bath for ice water (it is desirable, as indicated above, to cool birds quickly after dressing), (4) Deep freeze unit, (5) Benches for packing of birds (the line of operation is indicated by the arrows shown)

* All 5 windows, each 4 ft x 4 ft in size (each can be of glass with a frame, but hinged to open inside, with outside to be screened with fly wire, fly wire entrance doors are also shown on the plan) Floor to be concrete (rough finish to prevent slippery surface) with slight slope to shallow drain on centre line as indicated (This could be connected to a covered pit outside) This makes it easy to wash the equipment and floors and maintain the sanitary conditions necessary in a poultry dressing room

* Ordinary room type construction with the usual ceiling height and with top ventilation provided (screened) can be used Brick walls with

cement finish inside, or cement walls are suggested (A smaller set up could be used, but with less convenience for operations, or if a room is available at the farm it could possibly be adapted to follow the basis given in the plan) The capacity of such a unit could be about 300 to 400 fully dressed birds per day (This information may also be useful for large farms in developed areas wishing to use their own plants)



PLAN FOR SIMPLE ORESSING ROOM FOR POULTRY MEAT

Fig 18

Debeakers

These can be supplied as an extra aid For many areas they may not be used very much, but where birds are kept *on wire* it is usually necessary to debeak at about 6 weeks of age, and also if birds are *overcrowded*, feather plucking and cannibalism may be expected to arise (Debeakers can also be used for toe nail trimming as may be needed with birds kept on wire)

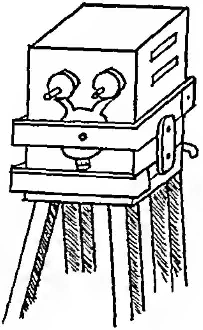
However, the practice of debeaking has some other helpful features Feed wastage is reduced greatly with debeaked birds—and birds may be quieter (also possible feather plucking or cannibalistic outbreaks are prevented) *Debeak by cutting the upper beak of the bird halfway between tip of beak and the nostril*

Points on handling the debeakers The following points on setting it up may be useful

* The debeaker removes the beak of the bird not actually by cutting it off, but by burning the beak by heat, hence connection must be made to electric supply (A C current and check for voltage) Providing a long cable (of heavy rubber flex for safety) so that it can be taken into a shed if necessary—is helpful (Gas operated debeakers are also used)

* The debeaker has to be set so that it can be used easily, so put it on a stand, or screw it to a small table at convenient height (about 2 ft 6 ins to 3 ft to bottom of the debeaker for a person of normal height) Then adjust the length of chain or wire (about 12 or 14 gauge is strong enough) so that

it is possible to easily work the pedal at ground level to move the debeaker plate, and leave both hands free to hold the bird being debeaked



De-beaker
Fig 19

* When debeaking a bird one method is to hold it firmly in the right hand by the legs, and put the forefinger of the left hand in its mouth, so that the top beak can be put against the plate (which should glow red) for cutting, but keep its tongue out of the way (Also, be careful to keep the knuckles of fingers from the hot plate—some safeguard against this by putting some sticking plaster on the knuckles of forefinger and middle finger of left hand)

* "Cut" or burn off the *top* beak by exerting pressure gradually with the foot, *and make the cut about halfway between the point of beak and the nostril* The beak can be held level or sideways as wished while doing this

* Debeak *all* the birds in a pen at the one time—not some only

* All do not debeak male birds in a breeding pen, but a number of operators do so

* If debeaking on a windy day have a shield against the windward side, so that it does not blow on to the plate or it may be too cool to do an effective job Avoid debeaking in very hot weather if possible—cooler weather is best

* Birds debeaked correctly in this way do not show any signs of distress, and, as indicated previously, they also do not waste feed from hoppers, or feather-pick one another (they would find it difficult to pick up grain from litter for a day or so, but can feed quite well from an all mash hopper)

Footnote Layers are usually debeaked at about 16 weeks to 17 weeks of age to avoid slightly upsetting them when in lay Should no signs of trouble be evident, there may be no need to do the birds Overcrowding, incorrect feeding, lack of fiber, etc, *may* be causes of feather-picking, but in other cases with ideal conditions in every respect it may occur, in which case

debeaking is used. (It is done as a precaution in many Random Sample Tests at about 16-17 weeks stage) The debeaker could be stored in the feed room to be used as required With reasonable care no major maintenance problems should arise, other than as with a normal electric element

Equipment for a Simple Demonstration Training Centre

This is considered of vital importance (as indicated in the comments under Appendix 5 on "Training Courses for Poultry Keepers")

The larger equipment in this Appendix is, in the main, for the bigger units, but is *not* for smaller private operators *or for the training of them* Accordingly, the type of hand-operated equipment they would be likely to use has to be demonstrated to them The items illustrated here are all simple in the extreme, but are efficient for their purpose for small operators A few points will be given about each

The hand-operated mixer Made from a 44-gallon drum—details are given in Chapter 14 It can efficiently mix—*provided* all ingredients are placed in even layers—up to 200 lb of feed (and can be used generally with concentrate received from large centres for mixing with local bran and grain to form a complete feed) Low in cost, it can nevertheless work well and requires very little maintenance attention It is easy to turn when on the level—if set at an angle a large drum of this type is very heavy work for hand turning

A hand-operated crusher This is satisfactory for the purpose Only about 10 lb of ingredients daily per 100 layers needs to be crushed—the balance does not need it (*total* feed used is 25 lb) Hence this type of small hand-crusher can serve for a side-line unit if wishing to mix own feed—*or* where wishing to crush some grain to put with the concentrate purchased Greasing is needed—and after a period the plates will wear

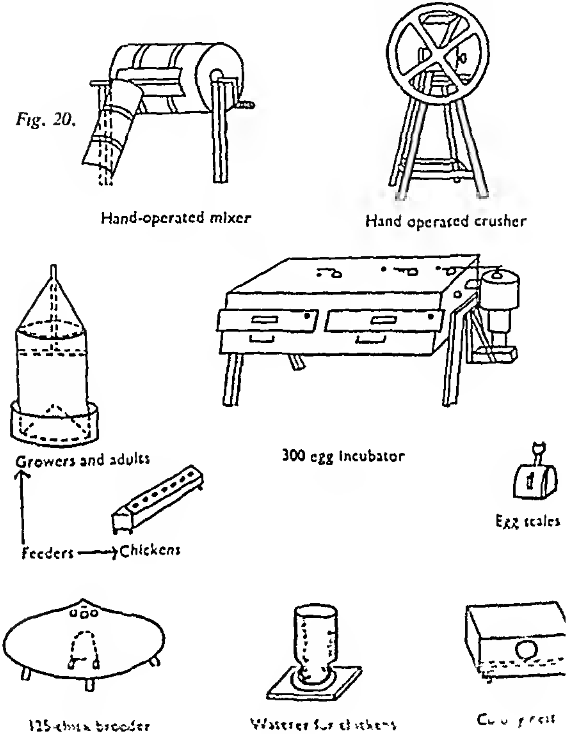
The hanging feeder This is a *very important* item to demonstrate, as feed waste can put a unit "out of business" The type shown is illustrated and described in Appendix 1 It has been proven efficient in operation—with 6-inch high sides, 2-inch feed gap, and only 2 inches of space under the barrel (Remember this as 6-2-2) This is stressed as many hanging feeders being used are causing costly waste This waste is demonstrated in Appendix 8 on Management

The chicken feeder For use with the chickens in the first stage—after a few weeks they can use the larger hanging feeders placed in the litter The "legs" are to keep the feeder above the floor litter Can also be a circular type with feeding holes on top for the first stage

The chicken waterer For use in the rearing and growing stage with the chickens Made of plastic or glass so that water level can be seen (This is the type which keeps water at set level in drinking tray) The important point is that it *must* be set as shown in a shallow tray or box of sand to prevent spillage making the litter wet and causing trouble with the chickens (Alternatively use inverted earthenware-type pot in the tray)

The 300 egg kerosene operated incubator For hatching the chickens Instructions for handling this type of incubator are given in Chapter 9

Fig. 20.


Hand-operated mixer
Hand operated crusher
Growers and adults
300 egg incubator
Egg scales
Feeders
Chickens
125-chick brooder
Waterer for chickens

Egg scales A simple balance scale to show egg-weighing, and the need for observing market grades since eggs are bought on quality and weight

Note The output of feed and chickens from a hand-operated unit of this type can be quite significant For full details refer to Appendix 5 on "Training" The incubator can hatch *over* 1000 chickens in a season, and the feed mixer and crusher can supply feed for over 500 layers with ease More can be handled if needed This type of unit can be very helpful for starting projects in areas without power facilities or for village poultry expansion Hence, where electricity is not available, this hand-operated equipment can *provide a good substitute*, and make possible an efficient small-type unit

APPENDIX 7

From Local Desi Stock in Developing Areas to Improved Type Laying Birds—Further Points on How to Carry Out a Breeding Programme

OFFICERS in developing areas are often charged with the responsibility of improving results with the village stock, and a gradual upgrading programme is usually tried, in order to do this, with the use of imported stock as the usual medium These pure lines of improved stock are usually established at Government-controlled centres and this in turn brings about the need for keeping the standard of these improved lines at high level If they are only mated each year on appearance, their performance will soon decline This means that a breeding scheme for these becomes necessary Information on this has been given in Chapter 6 relating to points for the selection of stock, and also, under Table 5, a chart approach to the breeding programme For the further benefit of officers who may desire more explicit material to assist in this very important work, a fairly detailed coverage of all needed moves is given in this Appendix This gives two alternate methods for study, a chart approach and a step by step written procedure

The type of building needed to make it easy to handle such a system—*and* of design to suit tropical and subtropical areas—is given in Appendix 2 under Part 3 This is a most efficient type of building, and makes it practicable to do this work easily, with reasonable investment for the facilities needed

Introductory remarks on practices existing in developing areas The local or desi breeds of poultry which have been mainly kept in the villages have many attractive features They are very pleasing in appearance, and are adapted to the difficulties of surviving in the presence of predatory animals, being multi-coloured and very active, which helps them to protect themselves against their enemies They are well adapted to the local climate and environment and to living off the land, and the females are excellent as setting hens and as mothers for the rearing of chickens Where the conditions are favourable with all the year-round green vegetation and insect life, pickings, and so on, coupled with the fact of only a few birds in a given area, they have been and still are quite profitable, as they

Fig 21

A view of desi birds on range They can be quite profitable when only a few birds in villages and good range is available When poultry numbers expand then extra or special feeding upgraded or better type stock and enclosed conditions such as with deep litter practice become necessary

then produce eggs without cost of feeding, housing, etc Also they are very choice birds for table purposes, having attractive appearance and flavour when prepared for eating There are two main points only in which they are lacking and which are necessary nowadays *if poultry numbers are to be increased in areas where birds have existed on range pickings*, these points are (i) the number of eggs they can lay in relation to the cost of feed, and (ii) the size of the eggs

It is difficult to carry out extensive breeding work with them

Improving by introducing pure breed lines This has been done in many areas by the introduction of Australorp, White Leghorn, and Rhode Island Red male birds to the village each year to maintain a steady upgrading and in an endeavour to remove desi males This means that the progeny between the pure breed males and desi females will be improved stock, giving more eggs, and because they are automatically bigger birds (when a large breed is mated with a small breed the resultant stock is about half-way between in size) then the eggs are automatically bigger because egg size is linked with the body size of birds laying the eggs (A close correlation exists)

Crossbreeding improved lines—a further stage There is a further stage in this upgrading of stock work Certain problems have shown up in many areas with the introduction of the pure breed males in the villages, they find it rather difficult to acclimatize themselves when delivered at full-grown stage, also, being all one colour, they stand out rather clearly and are an easy prey to predatory animals

This has been overcome by adopting *the practice of mating the two improved pure lines together to produce crossbreeds,* which have advantages that we shall enumerate Also, if the crossbred birds are sent to the village at half to two thirds grown stage (*about* three, and up to four months old) when they are more easily able to adapt themselves and are quicker in their movements than the fully grown adult pure-bred males, their survival level is expected to be very much higher A further point of value is that they are adaptable to climatic variations—on plains or hills—and hence will do well in all areas It costs less to produce two male birds of this type at this stage than *one* large pure breed male of six to seven months of age

Advantages of the crossbreds These have many advantages over the pure breeds, some of which are as follows

* Crossbreds grow quicker than pure breds, particularly up to the 12 weeks old stage, and being stronger and more vigorous are easier to rear than pure breeds

* They are multicoloured and can thus handle village conditions better than White Leghorns in particular, and, being more vigorous, can be expected to have a much higher survival rate

* The birds when finished for laying, and the young cockerels at *3 months old*—"griller" or "broiler" stage—make excellent table birds, weighing much more than pure breed cockerels at this age—and these too are profitable meat birds

* For the commercial or sideline producer, and of course for the villager also, the pullets have the great advantage of having been shown to *lay about 1 to 1½ dozen eggs per year and more than the pure breeds from which they are bred This means more eggs for no extra cost*

This has been established as proven as the result of work of the Commonwealth Scientific and Industrial Research Organization Poultry Research Centre in Australia, and also by the results of egg laying tests and surveys held there and elsewhere Most poultry operators now have crossbred flocks on their farms because of the increased lay obtained It can be readily seen from these advantages (and trials in many countries have shown similar results) that the *introduction of crossbred males to flocks outside the Government Centres* will further increase the returns of poultry operators and the overall production of eggs (including those of the commercial type operator using crossbred pullets from these matings between the two improved lines)

How to improve and maintain the pure lines It has to be recognized that the performance of crossbreds is not just because they are crossbreds—it depends upon the grade or standard of the two lines mated to produce the progeny Just as with other lines of stock, the better the parent lines, the better the results for the crossbred progeny So breeding work has to be carried on at the Government Farms on correct modern breeding lines to maintain and gradually improve the pure breeds Otherwise the imported lines will gradually decline in performance This requires the facilities of sufficient numbers of small unit pens to enable sufficient families of progeny

to be tested to gain accurate information, and these will be provided The techniques used will follow the now proven sire family breeding scheme system The efficiency of this system has been shown by the very high laying figures obtained in the Random Sample Tests being conducted in Australia, by those entrants whose lines of stock have been bred and improved in performance by the use of this easily handled but most efficient breeding method A description of how to handle the implementation of this system follows in this Appendix

How to produce crossbreds for *better* lay. White Leghorn males only require to be mated with Australorp or Rhode Island Red females (or the reverse mating) to produce crossbreds from these two improved lines This can be done on the Government Farms or Centres The crossbreed eggs or chickens can be made available through the extension centres As previously indicated, the crossbred pullets are hardier than the pure breds and lay more eggs (up to 1½ dozen or more eggs in a year) The cockerels fit in better with local conditions, and are better table birds than the pure improved lines from which they are bred The crossbred progeny pullets or cockerels can be easily identified by the mixtures of coloured feathers showing among their plumage as compared with the parent lines being all one colour No extra work or cost is involved—just use males from opposite breed

Future needs As the poultry industry expands and considerable numbers of improved-type chickens are called for, in addition to the large numbers produced by upgrading local stock by crossing with the males from these lines, a further adaptation in breeding practice can be used *if* the supply of pure breed stock for mating is insufficient to meet the demand

This is known as crisscross breeding (The process was discussed in a *paper by F Skaller*, "*Heterosis from Crisscross Breeding in Poultry*", *in* proceedings of the 10th World Poultry Congress Edinburgh 1954, pp 59-64)

This method can maintain, but not increase, the initial gain from the crossing of the two pure breds, and is useful when pure-breed females are in short supply The crossbred females are used from each generation, being alternatively mated in each year with a White Leghorn then an Australorp male, then a White Leghorn, then Australorp and continue in this way This also means a higher number of chickens for a given number of females—because of the higher laying rate of crossbreds This means that a relatively small number of pure breeds are needed for producing males only principally, and the females are taken from progeny bred from the crossing Multiplication of large numbers of stock under these conditions is possible if a shortage of pure bred stock exists Only about 10% of males are needed as compared with the number of females required for breeding replacement stock each year Efficient and sound upgrading of local stock will also be obtained by using the "*crisscross males*" bred in this way from the improved lines The procedure then is the normal one with upgrading methods They are *mated with desi females* in the same way as crossbred males—or pure breed males—*in the first year* (The desi males have to be removed—usually on barter basis for the males being

introduced) In the *second year a further supply of these crisscross males* would be *mated to the females bred from first—or previous—year mating* This is *again repeated in the following year In each year of the second and third year upgrading the males from the previous year should be removed* (After this the general level of the stock should be satisfactory with occasional re-introduction only) By these various means a very high level of improved blood lines can be introduced in the villages About 75% of improved blood lines in stock can be introduced by mating for only 2 years *provided* that the desi males are removed Tremendous multiplication can be achieved of stock capable of reasonable production, after only 2 or 3 years of mating in this way, even with only limited sources of improved lines

Suggestions for a Simple Approach to a Poultry Breeding Scheme

Introduction

The suggestions which follow are for a simple breeding scheme as a possible basis for an easily handled approach to maintaining and improving the performance of improved pure lines of breeds of birds which may be introduced to an area They repeat some items of Table 5, Chapter 6, but this additional material gives a much wider coverage and also an alternate method of description These breeds may decline in their level of egg production, also in features such as egg size, when mated on physical characters only, also, factors of early maturity, mortality, growth, and inherent disease factors are some of the economically important features with poultry production which may not receive sufficient attention under such a system Accordingly, this simple testing method is suggested, as it can give a steady rate of improvement in laying results, and allow of selection for other characters also, while carrying out no more than ordinary commercial practice It requires no special facilities, other than enough small pens of commercial type, to mate families *and* enable sufficient numbers from each to be checked for a few months of the year This gives a significantly accurate record for use in evaluating the best families in each generation It enables the 'cream" to be taken off from each generation It incorporates the basis of modern approach in poultry genetics (It is recognized that the checking of individuals within each family also further improves the result, but this requires extensive facilities for single pen testing, or trap nesting, with careful accurate recording Those with such facilities can do so) For the general field with ordinary type commercial operation, very good progress can be obtained for a number of years by this simple method, without extensive supervision problems and the need for costly facilities as involved with very large scale specialized breeding units Therefore, it is submitted as a means of assisting in this field, with the wish that it may be of help to those with the responsible task of providing good stock as a background to poultry production expansion in a developing area

A Simple Family Breeding Scheme for Poultry

Facilities required Normal facilities on a Government poultry farm or centre can usually supply the needed basis for the simple family breeding

scheme. It is only necessary that sufficient small unit pens be available to enable each family to be mated separately, and also for small groups of the progeny to be tested for part of the year. (No trap nesting records are needed for this "simple approach". It is recognized that trap or individual testing—as indicated earlier—will increase "selection pressure" but it involves more facilities and expenditure, and is the province of very well-equipped establishments with comprehensive recording facilities.) *The simple scheme to be given is designed to give marked improvement in pure breed lines, in very few generations with facilities which could be expected on an ordinary commercial basis poultry unit.* In fact, the whole operation of the scheme does not involve any loss of commercial aspect or profit at all. The laying of the pens only is recorded and being housed in small groups a higher lay will be obtained in any case, so a farm can carry out the scheme—using only ordinary facilities—*and* obtain more eggs while testing the birds and improving the stock. In addition, of course, there will be the gain in the future with the higher rates of lay from birds after a few generations of this work.

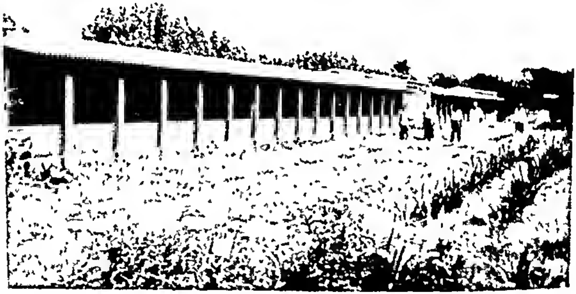


Fig. 22.

Officers responsible for poultry-breeding work, shown beside suitable buildings on a Government Centre. These two sheds contain 64 pens of the design shown in Appendix 2, shed No. 3 (where a view inside these pens is also given showing passageway and the waterers). Eggs can also be collected from the passage, egg recording cards filled in, feed observed, with an easily operated routine for all seasons. This type of building, while of substantial construction for long life, is particularly suited for experimental work and also for the breeding programme described in this Appendix.

Method of Procedure in the Simple Family Breeding Scheme

Selection of initial stock by "part year test" or at random. This needs to be carried out with care, as once the scheme is set in operation, new stock cannot be brought into the lines. Accordingly sufficient numbers of stock are needed at the start to prevent inbreeding becoming a problem, and also for testing of as many groups as possible to increase selection pressure.

Breeding factors such as body size and egg size—"things which one can see"—have a high heritability and can be improved by selection with individual birds, *but* a significant improvement in rate of lay can only be made by use of family averages using hen housed egg production figures (Hen housed records are based on number of birds *started* in pens divided into all eggs laid) To select the stock an ideal method could be to take a very large number of pullets at random and then they could be "trap nested" or tested in single pens for part of the year and the top 200 *or more* taken to start the families As no record would be available *at this stage* for the male birds—about 20 needed—these would have to be selected at random on physical characters only This aspect of physical appearance should be kept in mind with the initial pullets also that they be representative of "the physical standards" of their breed, so that the line of stock is pleasing and even in appearance, in addition to the egg laying ability Their rate of growth and egg production characters would be covered by their rate of lay for a set period (with all hatched at same time) with possibly 4 to 5 months lay in the "part year test" so that they can be started with one season earlier than waiting for a full year record Alternatively if about 500 or 1000 layers are available on the farm and an early start is desired *then select 200 or more* (could be up to 280 according to whether 10 or 14 per pen) *at random* So *stock for starting is 200 pullets or more, either at random or pre selected by testing of possibly 1000 pullets to take the highest individuals as determined by part-year check*

20 laying or breeding pens desirable, for mating of the families It is desirable that twenty pens be available to make up twenty families each of one male x 10 to 14 females, if starting with this number of 20 families then inbreeding is not likely to become a problem 10 pens *could* suffice as a minimum, but the higher number *also* allows heavier pressure to be applied, for example with only the three top families out of 20 taken for male bird lines (the top 15%) and with the female lines the top 6 or 7 families (the top 30% to 35%), which makes possible faster improvement than selecting the same number from only 10 families 20 pens for the mating of the families only means about 250 bird capacity, *and* at no more cost than ordinary laying pens of large type, as these small unit pens can be built just as cheaply because of lower roof level than large pens —also with short roof span lighter materials can be used, thus more than adjusting for the cost of the wire netting used for divisions (This in turn is much less than would be needed for outside yards—quite unnecessary as the birds should be housed intensively on deep litter for best results Also there is no danger of families mixing as could occur with birds flying over divisions in yards)

Provide up to 40 additional pens for testing the daughters of the families This is the only further item required—the addition of another 40 pens (500—600 bird capacity) for testing 2 groups of pullets per family making 60 pens in all If it is difficult to provide this number 20 added *could* be sufficient With this 20, plus the 20 used for the breeding pens 40 would be available for testing the pullets while the families which are in the breeding pens could be put in other quarters on the farm *but* it is easier

and much more satisfactory to handle if the pens are erected, also, their performance while the progeny are being tested is available as a guide. This could only work *provided* they have all been carefully leg-banded, so that each male and 10 or 14 females, which were together (as a family) in the pen are identified. This is necessary because those families proved best by the performance of their daughters must not be lost—they have proved themselves, and should be retained and used as long as practicable for producing replacement stock—*but* "like" results can only be expected *when the complete family is used of the male and the females he was mated with—not the male with other females or vice-versa*.)

How the simple recording of the breeding scheme is worked. The 20 pens are mated as discussed previously, and the eggs from each pen are collected daily and *marked in pencil* (not indelible pencil but ordinary lead pencil to be used) with the number of the pen from which they were collected (also the date of egg collection).

The eggs are set (with the oldest not more than 7 to 10 days of age as the longest period if held under good room conditions). When they hatch, *the percentage hatch is recorded and the chickens from each family are identified at hatching time* (having been set in separate trays) by means of wing banding or toe punching. This identification is carried out for all hatches in the season—but *only two or three hatches* (taken within a period no longer than 14 days) *will be used for providing pullets for the testing work*. The best time for this would be a hatching period in about January, *but* it is necessary to identify other hatches so that extra pullets of the same family may be available as required for making up pens from top families next season.

Supply of cockerels—take some from each family. This is important—the background for the cockerels can only be obtained from the performance of their half-sisters. Retain the day old cockerels required from each family with the two or three hatches from which the pullets will be tested, or take these from an earlier hatch if wished, but make sure that *about 12 to 15 day old cockerels* from each family have been kept (or hold these hatches as mixed chickens if chick sexing facilities not available). The cockerels are required until the best families are known—then cockerels from other than the three best families (as identified by the performance of the pullets) can be sold. Finally, *a check on the hatching results*: if a family hatches very poorly (and it was not due to management factors, as an example a male bird being heavily lice infested) then the family would be discarded. So, a check is needed only on hatching days, to identify chickens from each family, and record the percentage of hatching (a normal part of any incubation routine).

No recording for next 4 or 5 months. No further recording is needed for the next 4 or 5 months, other than a check on growth and mortality—the general routine on a farm of noting deaths in any pens or if any culls removed. If mortality of significant level occurred among the chickens when they are reared together at random in various pens, and it was found that the losses were confined largely to one or two families then these could be discarded—otherwise use only normal routine of culling of poor-

developing birds (also checking to see whether in a particular family) *So only necessary to keep an eye on growth and mortality over the next 4 or 5 months*

Procedure for testing the pullets during the part year laying period About mid May to early June (for most tropical areas) check on the pullets from the fortnight hatching period in January *Take these at random—using about 30 pullets from each family hatched at this time* Put them in *at least* 2 pens (2 pens of 15 pullets, or 3 pens of 10 pullets could be used, for each family) Possibly 18 families may be left, out of 20, at this stage Then, *the only work for next 5 months* with the breeding scheme (up to beginning of November—or October if an earlier start is wanted for the next year's programme *or* using basis of 300 days from date of hatching) is (1) *record the daily pen total for each* of the 10 or *15* bird groups, according to whether 2 or 3 groups per family (no trap nesting is used), (2) *weigh the eggs once (or twice if wished, and in this case take eggs from consecutive days) per week, to check* for egg size This is sufficient to give all the information needed

(A hint, which can *aid* selection pressure—when using these group pens with 10 or 15 pullets in each—is as follows After the pullets have been in the testing pens for *about* $6\frac{1}{2}$ to 9 weeks ($6\frac{1}{2}$ to 7 months old stage) they should be in lay *unless* they are late maturing birds These are the type which should be eliminated, so at this stage go through the pens carefully, and handle the birds quietly Those with the pelvic bones close together (only one to two fingers' width apart) indicating that they are not in lay or laying very few eggs, can be identified Then either cut off one "ear lobe", or put a distinctive leg band, with these birds They can then be identified later at the end of the test period At this time, when the top families are selected on their overall performance, *these* individuals among them can be taken out—because due to late starting they must be the poorer performers —and yet they may look good birds at the end of the test It will pay to use this guide as it makes possible some additional selection pressure, even with group testing) The eggs for the whole pen *can be* weighed as one lot for ease of handling to give average egg weight The egg weights, for pullets starting to lay, should be about $1\frac{3}{4}$ oz average weight (49 grams) and after 3 to 4 months should be averaging 2 oz weight per egg (56 grams)

> *Note* Any family consistently laying small eggs after 3 months should be discarded, as good size is a *very important* market requirement It has been found that if good egg size is reached in this time that full year size will be satisfactory Also size of first 15—20 eggs *per bird* has a high correlation to full year size
>
> (*This requires checking in particular with the families being used for the male lines*)

Checking results of daughters from the families at end of testing period Take the *total number of eggs laid by the 2 or 3 groups of pullets being recorded from each family* making no allowance for mortality (as hen housed figure is the basis to be used, to cover not only lay but adult mortality as well—this basis gives the true economic guide) also keep in mind *the rate* of lay Consistency of lay over last 3 months of period is a

factor to be considered if results are "close" Also as indicated above *check for egg size*—families laying well below the standards given should be eliminated (a few small eggs, with the greater majority for the group being large, should not be regarded too seriously—these would be eliminated when setting eggs in the machine, *but* set a high standard for the three top families from which the male birds will be taken)

Set a standard as desirable for egg production—possibly about 40 to 50 eggs for this part year winter test period, but it will work out its own standard The three top families (using average of both groups of 15 or 3 groups of 10, according to the pens available for testing) will be used for supply of males—(and pullets), while the next three or four best will be taken for pullets only, once this check is made all surplus cockerels can be disposed of from other than the three top level families (It cannot be avoided that a considerable number of cockerels have to be kept for some time, but they could have been reduced to about 10 per family at half grown stage to save feed costs Where chicken-sexing facilities are (or become) available, then only 12—15 cockerels would have been kept at day-old stage, otherwise, numbers can be reduced at about one month with White Leghorns, and possibly at two months with heavy breeds—when easily distinguishable as to sex)

Note —This part-year test has a high correlation with full-year lay, and, by making possible a new generation each year, is 1½ times as effective in producing genetic improvements, as selection is based on full production (Reference Dr J A Morris, formerly Officer in charge, C S I R O Poultry Research Centre, Australia)

Mating of the breeding pens for the next year Checking of the records as set out completes the breeding schedule programme for the year The unit now has available pullets from the top 6 (or 7) families and males from the top 3 families to mate with them A possible basis will be given as a guide—in example form Suppose pens 1, 9 and 17 were the top families and 5, 11 and 14 were the next best Then to make up 20 families for the breeding pens 6 males from 1 (one) would be each mated with 10 females made up of 2 females from each of 9, 17, 5, 11 and 14, another 6 males—from 9—would be mated with 2 females from each of 1, 17, 5, 11 and 14, finally another 7 males from 17 would be mated with 2 females from each of 1, 9, 5, 11 and 14 *So, in effect, a male is mated with some females from each of all top families other than his own* This procedure eliminates inbreeding problems

Note —If insufficient pullets are available from the groups tested (one may wish to have 15 females per pen with three taken from each family) then draw the remainder from pullets hatched earlier or later than the "check" or "test" groups—*they all have the same genetic background*

So the pens are mated, and then exactly the same checking procedure is adopted for the next and succeeding year (of taking the top families as determined by the simple group check method)

Using the families of the first (or previous) year In this first year, using the example numbers, the pens Nos 1, 9, 17, 5, 11 and 14 out of the 20

started with, were *proven as best families by the performance of their daughters*, with their value known by the next breeding season (*Also, by keeping these families identified*—in their separate pens for ease of observation—an additional check is made upon the groups of daughters checked for part-year lay These families are about 2 years old by the time their daughters have completed the part test period, so any inherited disease factors would be evident and their progeny discarded if need be Also the laying results of the parent families for a full 12 month period are available, and these results can be used as a guide—provided all conditions in pens have been kept uniform—to assessing the results of the daughters For example, if two families of daughters were even in results, but one parent family was much higher for 12-month lay, then the daughters from these would be taken)

Hence, take these families and use them to breed replacement stock for the next two or more seasons *Thus high level groups are known after only one year*—and each successive year a higher level becomes possible with the continued taking of the top level groups Accordingly by the use of this simple approach for a poultry breeding scheme, as submitted, a method is available which can make possible a marked improvement each year by use of commercial facilities only, in the standard of the pure breed lines* (*which in turn further improves the standard of crossbreds that can be produced from them*)

A Brief Summary of the Simple Breeding Scheme

1 Select 200 or more pullets (and 20 cockerels) at random from about 500 to 1000 birds (if facilities are available pretesting" for a part year check could be used)

2 Use 20 small unit pens to mate the families (about 250 birds)

3 Set eggs from each pen separately and identify the progeny from each, retain the pullets from all hatches—but keep only sufficient cockerels from each pen to give about 10 at fully grown stage (best to take the cockerels from the 2 or 3 hatches used for the pullets to be tested)

4 Check mortality and growth of the progeny to laying stage

5 Test up to 30 pullets per family with 40 pens used (with 2 pens of 15 for each family) or up to 60 small group pens (with 3 pens of 10 for each family) for 4 or 5 months lay The pullets being tested to be taken at random from 2 or 3 batches which were hatched within a period of a fortnight—*possibly* in January Take the total egg lay for groups (no allowance for mortality) and weigh the eggs at least once a week to *check for egg size* (Total pullets tested about 500-600)

6 Based on the total *hen housed* figure for the combined groups of daughters for each family over this part year period select for the 3 top families for *both males and females* and from the next 3 families for *females only*, or in effect the top 6 families for females but top 3 only for males

7 Mate cockerels from the 3 top families with an equal number of

females drawn from each of the other top 5 families—that is, with females from all families other than their own

8 Repeat this procedure in the next year—and so on

9 The parent families proven by the performance of their daughters should be used for producing replacement stock (*and* their full year lay can be useful as a guide in selecting the best daughter groups)

10 This simple breeding system makes possible marked improvement in rate of lay of stock, with use of ordinary commercial type facilities, and with a simple *recording basis*

For further information reference can be made to Chopter 6

*With the use of this system, and a new generation each year, marked gains can be made for 4 or 5 years Then gains will become less when a high level has been reached, and possibly full year testing, with increased selection pressure, may be advisable at this stage—with a new generation every two years only

Footnote —

Where trap nests are being used for individual selection within families (trap nests being the preferred method with birds under very hot conditions and with birds housed on deep litter), to give higher selection pressure within each family, then 4 individual trap nests would need to be provided in each pen These would be used for the full period of the part-year test over which the daughters are being checked All birds would need to have a numbered leg-band so that each egg laid by a bird could be recorded separately on the pen card

At the end of the test period *the overoll family overoge still decides*, but the *best* performing birds within each *best* family would be taken

Then the pens would be made up for next year in the usual way of equal number of females taken from *each* best family mated with a male *from* the remaining top family Sufficient females will *not* be available from the layers, in the best families, which were under test, so the balance can be taken from *some* families, but hatched at a different time Then, when in the breeding pens, some of the females will be *known* as top performers for egg lay and *egg size* as individuals (The balance will be from same families but without individual record) During the period of the breeding season, the trap nests would be used, and *the eggs from the known birds marked* so that they can be hatched separately This means *that the males* can be taken from these birds, and used not only for own lines on the breeding units, but for selling or distribution to those wishing to upgrade their own pure lines but who are not doing breeding work The eggs from the other birds in the breeding pen need not be marked separately

APPENDIX 8

Some Extra Points on Management for Use in Developing Areas (Useful for Developed Areas Also)

MANAGEMENT points have been given in Chapter 17, Parts I and II in particular, but have also been referred to at many places under Brooding,

Housing, Feeding, Routine Operations, etc To carry out all these tasks correctly is part of the function of good management

This Appendix gives some additional points in the format of question and answer, the items covered being taken from actual questions asked in the field As these queries are of the type which comes up frequently, it may be helpful to give some of them (with the answers) for the possible benefit and interest of officers They cover feeding, watering, deep litter control, chick costs, type of stock, and management factors The correct application of handling practice to most of these items can be a deciding factor for success or failure

Hanging Feeders and their Correct Use for Poultry Sheds

Question Would you suggest the use of a hanging feeder for use in poultry pens? I have seen some which seem to cause a lot of waste—which increases the feeding cost very much

FEED WASTE EXAMPLES AND HOW TO PREVENT THEM

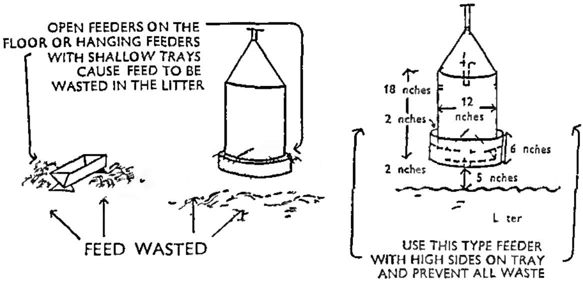


Fig 23

Excessive feed waste is a major economic problem—particularly with high feed costs—and also encourages vermin and predisposes to some disease problems and vices

Answer A hanging feeder is very efficient when constructed correctly, but unfortunately many types do cause considerable waste, and this factor alone can prevent the keeping of poultry from being profitable However, this type of feeder, when made in the right way, is not only reasonably safe from vermin, through being suspended above the litter, but if it is made according to the measurements shown in Appendix 1 it will not permit any waste This is because the bottom of the barrel is set firmly 1½ in to 2 in above the tray by means of three legs, which have two holes only, permitting the setting of 1½ in to 2 in high Then the tray is made so that the edge is only 2 in away from the barrel at all points *and* the side of the tray is 6 in *high* This is important to prevent the flow over the side of the tray

which will occur with adult birds and a 3 in or 4 in high side (due to birds "hooking" at the feed and "piling it up") Also do not forget that the centre cone shown by the dotted lines is very necessary to prevent stale feed in the centre of the feeder, and also to keep the feed flowing—it is no good having an automatic-type feeder which has to be shaken frequently to keep the feed flowing Once a week feeding (when the feed contains lucerne or clover or grass meal so that green feed does not have to be given daily) is practicable and possible with this type of feeder made with attention to these details (See illustration on preventing feed waste)

Keep in mind also that, although once-a-week feediog practice is used, feed can be purchased every 3 or 4 weeks, *provided* that it is freshly mixed when taken *and* that it contains stabilized powder-type vitamins (*NOT* fish oil emulsion, which may only keep its vitamin content level for about one week) Reference can also be made to Chapter 17 for information on other types of feeders that are also efficient—a box-type on legs can also be used

Water Supply—Correct Location is a Vital Need to Keep Deep Litter Dry—It is Necessary also to Avoid Overcrowding in a Pen

Question If water gets in the litter will it affect results, and in particular would it increase disease level in the pen Also, to couple another point with this, will the number of birds in the pen also have an effect?

Answer Yes—this is a good question It is asking for trouble with deep litter if it is allowed to get wet Damp patches or areas around waterers—sitting in the litter on bricks for example—due to the spilling of the water, will make conditions favourable for diseases such as coccidiosis, and also predispose to worm problems (Respiratory problems will also be aggravated) On the other hand troubles such as coccidiosis and worm problems are prevented, *when the litter is in good dry condition* (In practice, results will be much better than with any other system as an immunity is developed against coccidiosis—which would not apply with birds on wire for example—when litter is dry) For this reason *it is essential that the water supply be arranged* so that the waterer *is in a separate area*—with the top covered by *slats or netting* on which the waterer is placed, so that all spillage falls inside into this—and also that it can drain through a hole in this part to outside the shed Suitable methods are indicated in Appendix 1, and in the illustration given to emphasise this vital point. If you observe these precautions then very little attention is needed for the litter It then only needs to be stirred about once a week at most times of the year, and less often in hot weather, when you keep the correct number of birds in the shed, and disease level, due to the sterilizing action of well managed deep litter, is then kept to a minimum This is of course *provided* there is no overcrowding—by putting two birds where one should be—in which case another disease producing factor is introduced—with poor growth or lay plus chronic type complaints and increased mortality (Should it happen that deep litter does become damp it can be dried out reasonably well by mixing 1 kilo (2¼ lb) of superphosphate for every 15 square feet (or about 1½ square metres)) (Another point on drying litter

is—if it is dry hot weather, but someone accidently soaked it by tipping water into it when cleaning the waterer, then put it outside to dry—and then replace in the pen).

WATER SUPPLY LOCATION IN SHEDS
IS VERY IMPORTANT

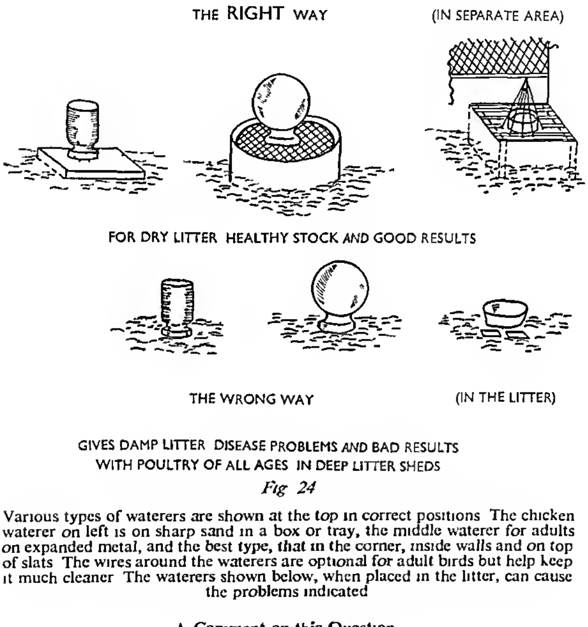


Fig 24

Various types of waterers are shown at the top in correct positions The chicken waterer on left is on sharp sand in a box or tray, the middle waterer for adults on expanded metal, and the best type, that in the corner, inside walls and on top of slats The wires around the waterers are optional for adult birds but help keep it much cleaner The waterers shown below, when placed in the litter, can cause the problems indicated

A Comment on this Question

It must be stressed again—*relative to this question*—that it covers two very important points in handling litter They are simple in the extreme but can be far reaching in results if ignored The simple fact of *waterers sitting in litter* and neglect of placing them in the correct position so that they do not spill into the litter—can set up the basis for a number of disease problems Further, if this combined with overcrowding in the shed such as trying to give only about 2 sq ft per bird in the pen—then it can really bring trouble As indicated above, it can mean chronic type complaints,

also a higher culling and mortality level in the pen, which means "uneconomic" returns due to this and the lowered production level obtained

Use of Deep Litter Sheds in Areas where the Ground may be wet —Also Soil and Climate Effect on Poultry

Question I would like to keep birds on the deep litter system but the ground where I would have to keep the poultry is very wet in monsoon period Can I keep them off the ground in any way? Also, do the area conditions of soil and climate affect results?

Answer Yes This is referred to in Appendix 2 on Housing Laying birds can be kept quite successfully in a shed built off the ground—in fact they have been kept in houses with 2 or 3 floors one above the other If you wish to keep them in a verandah then, for example, a cage 6′ by 4′ would hold 6 to 8 birds The bottom part would be solid, and the sides solid also up to 12 or 15 inches height—the balance to be of netting Then the normal type internal fitments for feed, water and roosts can be incorporated in this type cage So provided the floor of a shed is solid enough to hold the litter, and the sides also, part way, to stop it spilling out, deep litter can be worked very successfully in a shed raised above ground level Alternatively it is possible to make a prefabricated small pen 8 ft x 6 ft or 8 ft x 8 ft on these lines This could either have the bottom made in this way (on legs, solid bottom, and sides solid for 12—15 inches) or this unit be of sides and roof made to bolt together and then to fit over a concrete floor with dwarf walls (In event of a person moving, this would be the only part lost) (Some people have also had a deep litter unit on a flat roof of a building—when the litter is handled correctly there is no offensive smell at all and a "crowing" rooster or male bird need not be kept—the hens lay better on their own and the eggs are infertile "vegetarian" eggs) Another way in areas likely to be flooded would be a Dryden type shed on legs, and only the litter portion would need to be solid The roosting portion need not have anything underneath other than the netting—and night droppings could fall down underneath to ground level (Leg height of the shed to floor to be above flood level)

The answer to this gives a lead for the second point on soil When poultry are kept on deep litter—on either a rammed earth floor—or a "pucca" concrete floor—the soil condition has no effect on them Although climate may have some effect with birds on open range this does not have a marked effect with birds on litter, except that in hot weather production will be less than on normal temperature range (and litter may require to be sprinkled occasionally), and with very wet conditions the litter would require more stirring, and less birds should be kept in a pen for a given space Accordingly, when handled on deep litter, poultry could be regarded as the agricultural activity probably least affected by outside conditions

Shed Alterations Needed in Snow Affected Areas

Question In our area of operations we have some parts where we have snow on ground for a few months and very low temperatures Should we alter the shed designs to cope with this?

Answer This is a very good question Yes—for the small type Village Shed the sides would be made 30 inches (2½ feet or *nearly* 1 metre) high instead of 15 inches high as for use on the plains For the larger type shed for village use as in Appendix 2—the 20 ft x 15 ft shed—the ends are solid in any case so O K for all conditions For the 2 sides the 2 ft wall should be raised to 3 ft in front and 4 ft at back of shed, *and*, in addition, the hanging "shutters" at edge of the overhang should be put in position in winter, and this will apply to both sides This will give full protection and assist inside temperature level, but will permit the needed ventilation (As a guide to openings for the sides of the sheds *not less* than 25% of floor area equivalent should be provided for sufficient ventilation purposes) It is *vital* in areas with these conditions that the litter should have been *well built up* for 3 or 4 months *before* the cold period, or it will not work, and during this cold period stir it twice weekly Should it become damp on occasion, work in 1 kilo (approx 1 seer or 2 lbs) of superphosphate (or hydrated lime, *not* quick lime) per 15 square feet space as required These adjustments, *and* giving full 4—5 square feet per bird, will make it possible to deal with these situations reasonably well

Also for further information when brooding young chickens the brooder shed (or the laying shed when used for rearing) would be well closed up (but still allow for a little ventilation) and an auxiliary heater be used in the room to keep the air temperature outside the brooder at reasonable level (The temperature under brooder—for young chickens—about 90° to 95° and in the room 50° to 65°) Also do not put full quota of chickens under these very cold conditions For example, about 250 only in a 350 brooder, and only about 80 for 125 chick brooder

These points should make it possible to cope with the needed adaptations for these areas

Operational Costs to Produce a Day-old Chicken
(*Costs in rupees approx Rs 7 5 to Aust or U S dollar, and P is for paise—100 per rupee*)

Question What would be the approximate cost of producing day-old chicken, allowing for a reasonable price to be paid for the fertile eggs to be put into the incubator?

Answer Normal average market prices for all grades of eggs in the highest price season as received by the farmer, even in the best market areas in India *may* return about 2 to 2½ rupees per dozen net on the farm (equivalent to 17-19 P per egg) but is usually less When layers have been producing infertile eggs for marketing and are then mated by placing male birds in the pens (when fertile eggs for incubation are wanted) allowance has to be made for less layers in the pen, because of space taken by male birds—a slight reduction in the rate of lay, *and* care (which should be taken) with the quality and size of eggs being put in the incubator (or poor-quality market eggs will be laid by the pullets hatched from the eggs), also, the cost of raising and feeding the male birds has to be allowed for An ample allowance for these additional features requires that we should get about another 20% to 25% in returns to make it "worth our while" as it

were This brings the cost up to 2½ to 2 7/8 rupees per dozen, so allow Rs 3 to cover This means about 25 P per egg This is reasonable, as compared with the best market period, and also allows margin for costs of breeding work which it is taken for granted would be carried out on regional farms to maintain and improve the stock (where large specialized establishments employing geneticists sell stock they may charge a little more for this factor) The other cost which then has to be allowed for is the expense of incubation Provision for the cost of the incubator, the room, the power installation, attending the incubator, etc , means that considerable expense is incurred when all factors are covered The cost may be assessed as about 10 P per egg or Rs 10 per 100, which increases our cost by over 40%, making up about 30 to 35 P for each egg placed in the incubator This means a cost of Rs 35 per each 100 eggs set, and we would expect to get about 70 chickens from the 100 eggs set (but many operators may get more) However, working on 70 basis, we have a cost of ½ rupee per chick at day old stage, and where Governments are selling on "no profit no loss" basis (as this figure has allowed for Rs 3 per dozen for eggs *and* commercial custom hatching rate) it appears that chickens of mixed sexes could be sold at day old stage for about ½ rupee each This gives a working basis for periods of reasonable feed price (For further points check Chapter 8)

White Leghorns or Crossbreds in Villages

Question We have been selling White Leghorn chickens in the villages and trying to step up production, but many of the villagers say that they are too delicate and are not keen about them Is there any method of dealing with this?

Answer Firstly, the villagers are right when they regard White Leghorns as not suited for village conditions in many areas, and mortality rates both in rearing and for adult stage can be high They are suited to intensive conditions where kept inside a shed with regular conditions plus good management The other handicap is that the male birds, which form about half the stock when bought as mixed chickens, represent a loss to the villager because they eat too much feed for the weight they put on Accordingly this, added to the feeding cost of the pullets (always a heavy item for the villager in the first year of trying to start a unit) means that his pullets cost him too much, and in turn he is very unlikely to make much profit unless egg prices are quite high

This can be overcome to a *very* large extent by the simple procedure of supplying him with cross-breds—and this does not give any more trouble as it is just a matter of sending out the chickens in the same way The only difference is that White Leghorn males would be put with Australorp or Rhode Island Red females or the reverse mating *This crossbreeding is just a matter of moving over the males* Then the chickens rear much better due to "hybrid vigour", while the cockerels have ability to grow quickly to a good weight for a reasonable amount of feed, they have the right genetic background so that they grow faster *and weigh more* at 12 weeks than the pure breeds Accordingly, the villager can then usually show a profit even if only reasonable prices can be obtained

Further, the pullets lay better than either of the pure breeds from which they are produced So it is a vital factor, for a considerable period to come, that if village poultry operation is to be made attractive to villagers from an economic angle, crossbreds be supplied to him as has been demonstrated in quite a few areas to date—with increasing interest becoming apparent as the better returns are seen

The Economics of the Age of Poultry and Culling Practice

Question Mention has been made in our training courses about the need to replace stock each year and it has also been mentioned about culling Could you give me some more information on this and whether we should cull mainly for age only?

Answer The reason for the emphasis made on replacing *at least two thirds* of the stock each year, and also the emphasis on part year production (which means *all* stock has to be replaced each year) is because of the high production that a layer gives in its first year, and the fall in production in its second year It has been indicated that a good pullet laying 170 to 180 eggs of good size in its first year might only lay about 130 eggs in its second year (*and* if kept to a third year this might only be about 110 eggs) This means *provided* a reasonable price is being obtained for a bird at the end of one year lay (or 7 months lay), it usually pays to replace because of the extra eggs which will be obtained However, if the price for the "Cost for age" birds was low (only about Rs 1 or 2, while it costs Rs 5 to raise a pullet) then it could pay to hold about one third of the stock as second year birds—selecting them carefully by "culling" through the flock—but it would not pay to leave any bird for a third year

Other factors also come into it Shell condition of the eggs from pullets is better than from second year birds, and their resistance to hot conditions is better Also, if they are hatched at the right time, their production level is high during the higher egg price period, it is not the number of eggs only from layers over a year which counts—it is at what time of the year the greatest proportion of these are laid This gives the pullets a further advantage—as it is not profitable to be holding on the unit too high a percentage of old birds that may be in "moult" for some time So it is very necessary to see, in the various projects that centres or operators are given a *sufficient level of young pullets—and* that they were reared without being over-crowded (this is another reason for talking of 7 months production on unit—the young stock have the full shed for rearing which they will occupy as adults, so have plenty of space)

This crowding is one of the main causes of problems with *disease*—and of failure in some projects Birds overcrowded for floor space, water space and feed space, become stunted in growth and readily become subject to many disease problems such as respiratory troubles, etc , caused by their conditions

The question of culling is a very important one In the monthly routine reference in Chapter 17, it has been indicated as a required operation during many months It is a very necessary part of the economic operation

of a poultry unit whether large or small A careful operator will keep an eye on the pens at all times, and any birds looking "off colour" will be picked up and marketed If left they may later die—a total loss—but if detected early are quite alright for market The basic points to look for have been listed in Chapter 17 under "Culling"

The use of constant culling also reduces likelihood of high disease levels by removing birds which develop trouble, and may in turn possibly affect others So, to summarize for this question, it pays to *have a high level of young pullets* in the flock, because of high rate of lay, *and culling is very important* and should be part of the routine *at all times*—not just at the end of the year

Some Further Points on Energy Levels in Poultry Feed Ingredients

Question We are very interested indeed in preparing lowest cost poultry rations, as related to energy value for feed balance with concentrate use in particular Could we have some further feed ingredient contents, in addition to the wide range given in Chapter 14?

Answer This is a very good question and further reference follows here This (Table 28) is Table XI, taken from the very well known and valuable reference textbook entitled *Feeds and Feeding* (*22nd Edition*) by Frank B Morrison It will give you data on some further items, and covers both productive and metabolizable energy values

TABLE 28

PRODUCTIVE AND METABOLIZABLE ENERGY OF FEEDS FOR POULTRY

Feeding stuff	*Productive energy, Fraps' values*	*Productive energy, Titus' values*	*Metabolizable energy*
	Cal per lb	Cal per lb	Cal per lb
*Alfalfa, green, fresh	314	116	217
Alfalfa meal, 20% protein	314	385	619
Alfalfa meal, 17% protein	—	217	310
Animal fat	—	2,878	3,280
Barley	811	813	1,320
Beans, navy, cooked	792	—	—
Beet pulp, dried	220	207	279
Brewers' dried grains	1,005	747	1,144
Buttermilk, dried	707	786	1,247
Cabbage	—	64	118
Clover hay, red	405	299	—
Coconut meal, exp or hydr	619	585	779
Corn, dent, Grade No 2	1,092	1 079	1,550
Corn feed meal	1,009	999	1,356
Corn gluten feed	565	564	766

* Lucerne

Feeding stuff	*Productive energy, Fraps' values*	*Productive energy, Titus' values*	*Metabolizable energy*
	Cal per lb	Cal per lb	Cal per lb
Corn gluten meal	839	821	1,095
Cottonseed meal, 43% protein	694	800	1,159
Cowpeas	—	883	1,175
Distillers corn solubles, dried	853	1,020	1,395
Field peas	—	—	1,182
Fish meal	898	941	910
Hegari	1,048	1,114	1,597
Hominy feed	831	—	—
Kafir	1,059	1,082	1,502
Linseed meal, exp	571	507	692
Liver meal	1,092	1,031	1,373
Meat scrap, 55% protein	724	949	1,249
Meat and bone scrap, 50% protein	784	874	800
Milk, cow's	—	203	284
Millet, proso	985	975	1,362
Milo	1,119	1,099	1,470
Molasses, cane	714	—	—
Oats	760	810	1,220
Oat meal or groats	1,151	1,162	1,630
Peanut meal	861	856	1,134
Potatoes	—	215	321
Rice, rough	777	786	1,216
Rice bran	717	698	1,072
Rice polishings	984	1,044	1,555
Rye	814	886	1,319
Skim milk, dried, not over 5% of mash	525	765	1,232
Skim milk, liquid	—	107	145
Soybeans, cooked	—	1,023	—
Soybean oil meal, solvent, 50% protein	—	790	1,142
Soybean oil meal, solvent, 44% protein	565	761	1 000
Sunflower-seed oil meal, unhulled	—	580	772
Sweet potatoes	—	269	425
Tankage, 60% protein	676	814	1,198
Wheat	1,024	897	1,490
Wheat bran	478	494	510
Wheat, gray shorts, or flour middlings	720	756	1,190
Wheat, red dog	983	—	1,380
Wheat, standard middlings, or brown shorts	581	694	810
Whey, dried, not over 5% of mash	490	786	1,242
Yeast, brewers', dried	476	572	1,123

The Vital Importance of Management Factors in the Keeping of Poultry

Question It is disappointing that in a number of projects the targets for rearing and laying results have not been achieved, but on the other hand in some other areas have been quite successful Why should we not expect good results in many more cases as we have arranged supply of good stock —all from the same centre—and we made sure that correctly balanced premixed feed had been supplied? What are the likely reasons for the failure in many of the areas?

Answer This is a very good question indeed It covers one of the most important aspects in poultry keeping as to why some people succeed and others do not It applies in all countries of the world—in many cases it is considered that of three people entering the industry only one will be a really successful operator and this can apply where the three would purchase stock from the same hatchery and buy their feed from the same feed-firm or centre *Accordingly the reasons for these failures are right on the farm unit This is tied up with what are called management factors, or the "man" in management.*

Various features of this will be given as a guide—*the theme has been stressed in various chapters in the book*

The Rearing Quarters—Many of the causes of failure will be found in this section of the unit The reasons are usually some of the following:

Insufficient floor space was allowed—this meant overcrowded sheds Pullets were only given ½ sq ft. per bird in the shed to 12 or 14 weeks—space which was sufficient to 4 weeks only—and near laying stage still only had about 1 sq ft.

The Result High mortality—balance of stock does not grow fully, comes in to lay 2 or 3 months late and then produces at a low level—develops respiratory troubles (Demonstrations for field days have been arranged to illustrate this by taking stock from the same hatching and with all given the same feed, *BUT* half of the hatching placed in same type pens at *double* the recommended rate. *Result*—as stated above A most convincing demonstration—and the reason for many of the failures to achieve good results. *adequate rearing space is a vital factor for success*) Another cause is poor water arrangements. Use simple waterers which chickens cannot get into *or* from which they cannot spill water into the litter.

The Laying Sheds This is the other main sector where reasons for failure are found. Let us presume that the chickens were well grown (if poorly grown, owing to conditions mentioned under "the rearing quarters", then the problems will be just that much bigger) and they are brought into the laying sheds They are *then frequently placed in a shed which lacks even the basic essentials for success—not enough water space—not enough feed space* and often feeders which cause costly waste of feed—and *no roosts provided* —and *very little nest space* and *frequently insufficient floor space also.*

In very many cases it is felt that provided a shed is erected, some feed given, and birds put in all will be well

The birds can only produce at high level and continue to do so if the space provided, and the internal fitments provided in the shed, are correct

Refer to the Plan given in Appendix 2, and Chapters 10 to 12, for just how much space is needed and how to arrange the fitments The next factor to check for in the laying shed is regularity of attention

The Feed It is essential that the feed supply be kept in the hopper (which should give at least 5 ft feeding space per 25 layers) at all times—or production and resistance to disease will be reduced Also, the hopper should allow free flow, so that they can get the feed easily Many cases of very low production reported have been due not in all cases to unbalanced feed but just *shortage of feed*—neglect to remember to fill the feeders *or* insufficient flow—which means birds may lay at 10% rate instead of 60% rate (the result of a subsistence or maintenance diet only)

The Water It is vital that water be available at all times—a leaking waterer, or failure to fill the waterer for only one full day can be the start of a "false moult"—birds will then drop feathers ("Force moulting" is carried out by cutting off the water supply for a day or so and production may be cut off for some time—see Chapter 17) You can always tell the need birds have for water—they drink twice as much by weight as they eat of feed—watch how they crowd the water supply even if it has only been cut off for about one hour This is the cheapest part of the poultry ration—but it is neglected by many operators Another major fault is lack of watering space 100 birds cannot drink at a single cup—but some are given only this, instead of the 6 ft of space needed

The Roosts Not enough roosting space provided so that the birds roost on feeders, waterers, nests, window ledges, etc (as happens in pens where no roosts are given, and consequently respiratory troubles occur) Even an open sided shed, which normally allows enough ventilation in warm areas, is ineffective if the shed does not have the correct provision of roosts (6 to 8 inches per bird on firm roosts set 18 inches apart and level—placed about 2 ft to 2½ ft above the floor) So, this is a very important need for good results—and disease prevention (Some authorities have advocated no roosts with layers, as with raising meat birds to 10 weeks of age only, but opinion is again reverting to the use of roosts for layers for the reasons given, the birds *show* their desire for roosts (or perches) by sitting at night as indicated above)

Nests These should be ample in number or space, and should be provided with clean material (2 to 3 inches or 5 to 7 5 centimetres in depth) Also broody hens should be removed to broody coops and not left in nests (See Chapter 17, part II, for further information)

Care in Handling the Birds Not usually given enough attention The attendant pulls birds off the nest when about to lay (and they become a loss later) or kicks them out of the way when trying to fill the feeder and has the birds flying up in to the air and in a nervous and disturbed condition whenever he enters the shed It is vital that birds be handled in a considerate manner—one can always tell if this has been done by the way birds react when one enters a shed

This means

* When entering the shed always make the same sound, either a whistle or a knock on the door or something of that nature, so that they expect a person to enter and then they do not fly about the shed.

* When collecting eggs feel carefully under the bird which may be laying for any eggs underneath (even if the bird may give a slight "peck", so that she is not likely to be injured as can happen if thrown off the nest when about to lay).

The successful operator always has the hens quiet in the pens in this way—it is a very big factor, but can be easily achieved by showing a little consideration, plus giving enough floor space, a constant supply of water and feed and sufficient roosting provision. As a result he obtains expected production figures. Also, remember that the less birds in a group (less "stress") the easier it is to obtain these conditions—and that small groups lay more eggs per head than big groups; so keep in mind the value of subdividing the pens—as indicated in Chapters 4 and 12.

A long answer to this question, but it covered some vital factors which can mean the difference between success and failure—realization of these would mean less blaming of feed or stock for troubles which can be controlled on the farm.

Note: The officer could also refer to Chapter 17 for further information on this vital aspect. Also it should be kept in mind that although these points have been given for laying birds, nearly all of them (except references to roosts and nests) apply also to meat birds or "broilers" in relation to care in handling, adequate feed and water space, dry litter, and sufficient floor space. See also Chapter 18 on this aspect. Finally, it is again emphasized that these *management factors* decide the difference between *failure and success.*